DECEMBER 15, 1952

Electrical World

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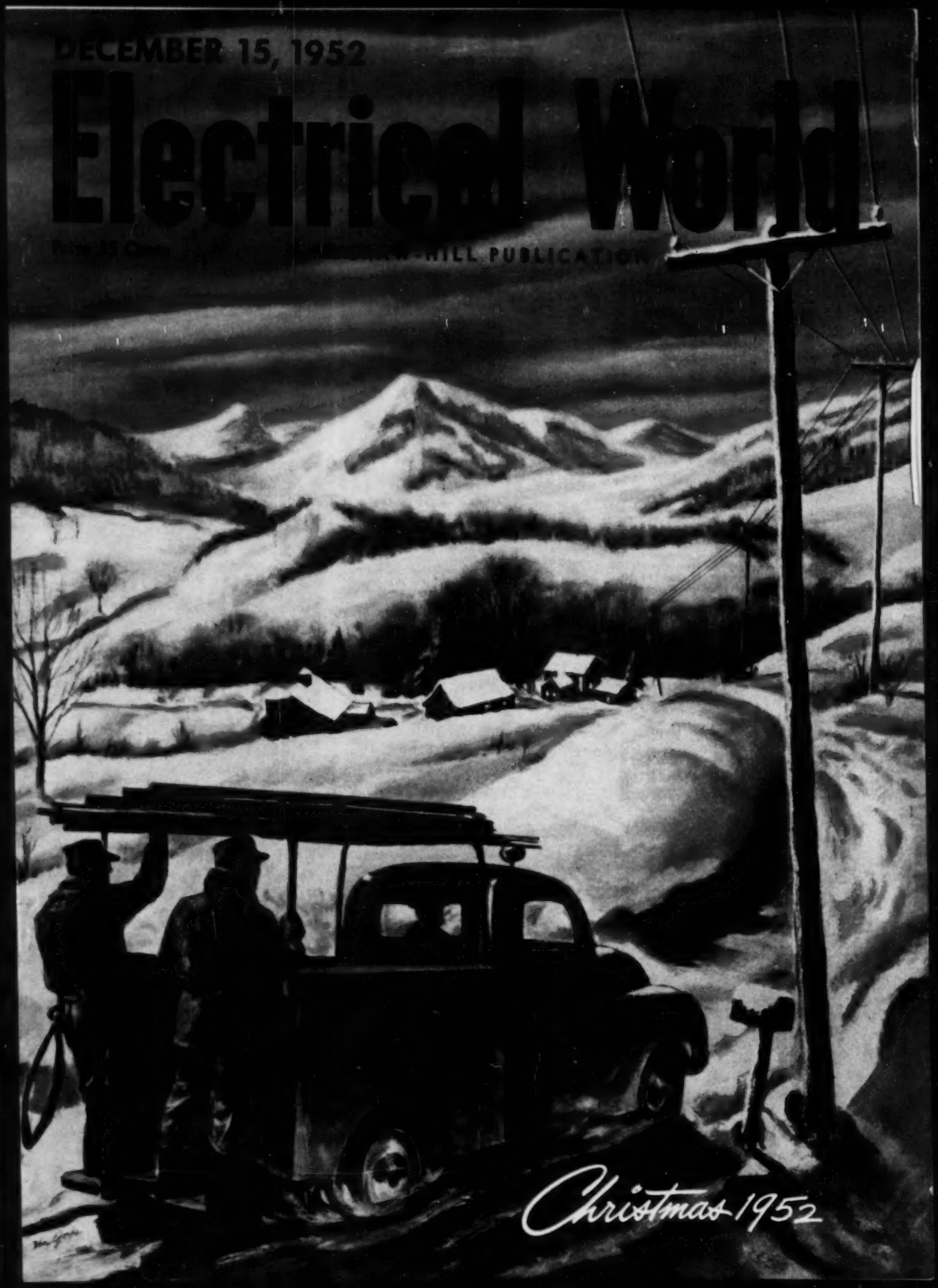

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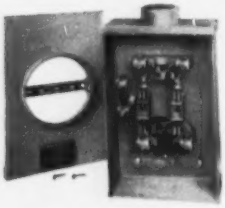
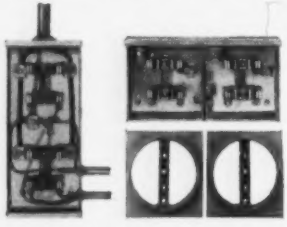
Single or multiple units (saves stepping in the field). Provisions for fifth and sixth jaws. Reversible jaws for vertical or horizontal mounting. Two or three hubs—1" or 1¼". Pressure connectors. Finished in gray baked-on Melamine (a really rugged finish).



OUTDOOR WEATHERPROOF—RAINTIGHT METER SOCKETS

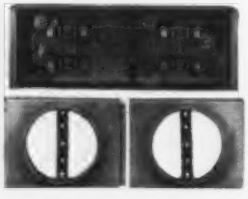
A medium duty socket. Contact surfaces of jaws are silver plated. Single phase installation can be converted to polyphase by substituting polyphase blocks. Sturdy cabinet, built of corrosion resistant steel. The finish is baked-on Melamine. Deep tipped top with hub for 2" conduit, is welded to sides and back. Cover slides under top, over sides and bottom, making device completely raintight. An economical unit.



OUTDOOR SOCKET METER TROUGHS

(Vertical or Horizontal)—

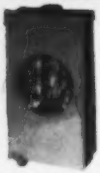
Single or multiple units. On multiple units, line and load terminals at each meter position are lay-in pressure type connectors, which simplify bussing. Line connectors for #4 to #3/0 cables. Load connectors for #4 to #1/0 cables. Made in sizes to accommodate from one to six meters.



INDOOR SOCKET METER TROUGH

(Horizontal)—

Available in one to three meter positions. Can be ganged readily. Line and load terminals are pressure type. Line connectors for #4 to #3/0 cables, load connectors for #4 to #1/0 cables. Lay-in connectors simplify wiring.



TYPE H.D. HEAVY DUTY METER MOUNTING DEVICE

Has a maximum continuous carrying capacity up to 200 Amperes. Can be used with any standard 4 or 5 terminal meter on 1, 2 or 3 phase, 3 wire installations. Where the standard 50 Ampere meter is used, the heavy duty mounting is suitable for 200 Amperes intermittent duty and 150 Amperes continuous duty. Vise-jaw terminals for high-strength, high conductivity. Pressure connectors take line conductor sizes from #6 to #4/0. Equipped with transparent acetate shield for safety in installation and testing. By-pass clamps permit removal or testing of meter without interrupting load. Corrosion resistant, weatherproof case. Supplied with 2" or 2½" hubs.

MODIFIED OUTDOOR SOCKET METER TROUGH

An economical device for those whose requirements call for a compact, single position unit. Plenty of wiring room. All connectors are pressure type and take up to #1 wire. 1" or 1¼" hubs available. Melamine finish.

COMBINATION METER SOCKET AND SERVICE CONTROL EQUIPMENT

Murray meter sockets are available in combination with service control equipment. Factory assembly assures a rock-solid, perfectly aligned unit. Service control equipment includes Fully Magnetic Circuit Breakers. Murray Magnetic Breakers always carry the full load, are never affected by ambient temperatures. The sun's rays, for instance, will never cause Murray Breakers to trip. Both socket and service control equipment are finished in baked-on gray Melamine.

Murray can fill all your needs for socket type meter mounting equipment. You can choose any device you need—from the round socket to heavy duty equipment. Ordering and stocking or specifying are simplified when you buy from one source.

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7. Combination Meter Socket and Service Control Equipment ..... ☐

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Housley of Alcoa and AIEE

J. Elmer Housley is a firm believer in the virtues of aluminum and the American Institute of Electrical Engineers. It would be rather surprising if he weren't. Since 1915 when the University of Tennessee made him an electrical engineer, he has been employed by the Aluminum Co of America or a subsidiary. For about the same time he has been active in AIEE. He was national president in 1946-47.

John, he is much better known as Elmer, is a typical busy engineering executive. He puts a lot of enthusiasm into his work. And he put a lot of both into his article on aluminum bus installations appearing in this issue. It is typical of him that when asked what he did with his spare time, his reply was, "What do you mean by spare time?"

However, he did admit to having a few hobbies such as attending the theatre, managing Tapoco Lodge in the Smokey Mts, and smoking a pipe or cigar. But he claims the one unusual thing about him is that he has never gone fishing, not even in the lakes behind the power dams where he has worked.

The Front Cover

Again EW's Christmas cover carries the theme that while most Americans are home enjoying the biggest holiday of the year, the employees of power suppliers work on as usual to provide reliable service. In the background is Haystack Mt near Pawlet, Vt. The artist was Theodore Van Gorp of McGraw-Hill's illustration department.

Electrical World

Published for 78 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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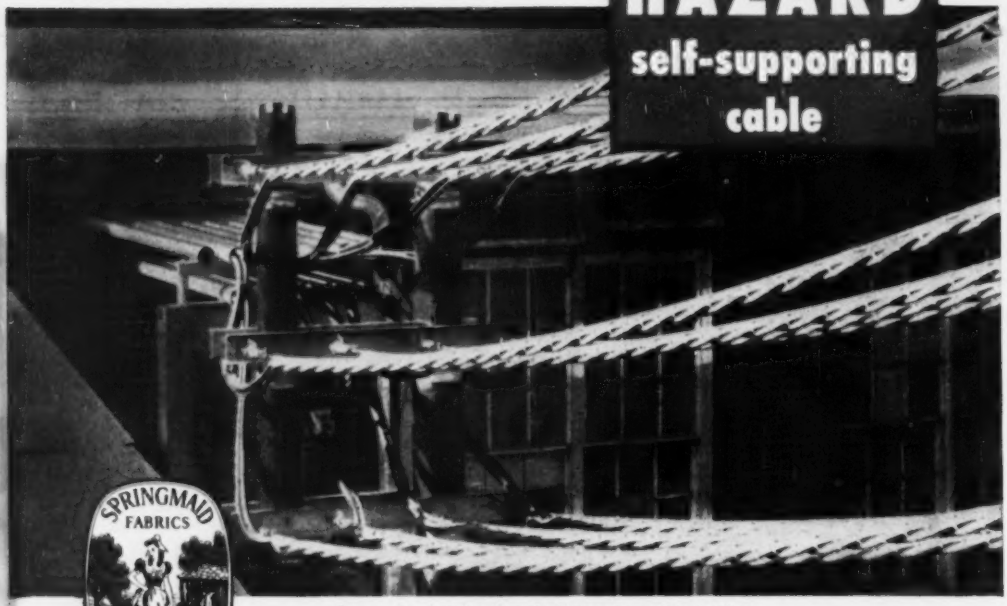
abreast of the trend in industrial power transmission

...SPRINGS MILLS selects HAZARD self-supporting cable



From main substation, Hazard self-supporting cables distribute power to the main buildings of Springs Mills plant. Note the neatness and compactness of the installation. Cables are readily accessible for splicing; all-in-one construction makes relocation easy.

SPRINGS Cotton Mills, among the most modern in the textile industry and home of famous Springmaid fabrics, demand the finest when it comes to industrial power transmission. Safety, compactness, ease of installation, appearance and low cost were uppermost considerations in the selection of Hazard self-supporting cable for power distribution at the Springs Plant.

Hazard self-supporting cable is insulated with Watertite heat- and moisture-resistant insulation and protected by Hazard's rugged Hazaprene ZBF sheath. This abrasion-resistant jacket stands up against the destructive conditions common to industrial installations and, in addition, more than meets the requirements of the Federal Bureau of Mines and the Pennsylvania Department of Mines for flame resistance.

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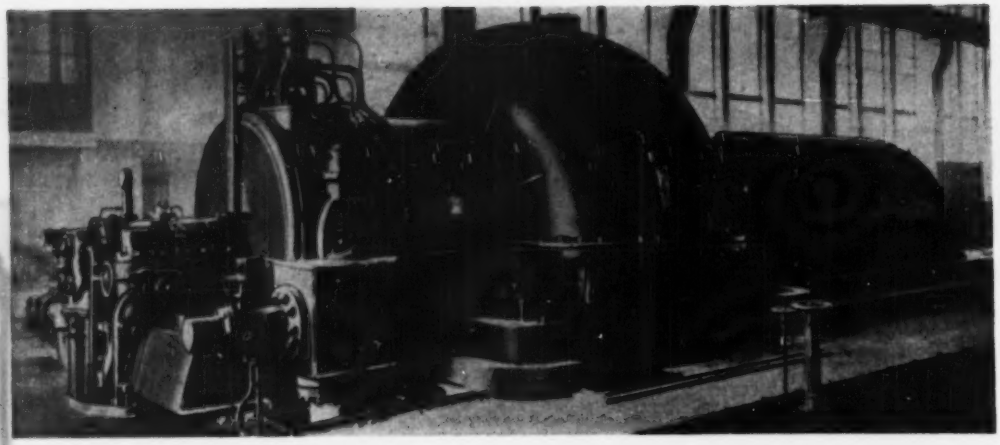

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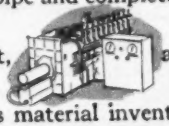
because . . . both quality and economy are guaranteed. Piping is fabricated in Grinnell shops under ideal conditions, with modern equipment, by personnel qualified in all classes of work. Price (determined in advance) includes competent engineering, scheduling and shop sketches, efficient material procurement. Grinnell supplies heat, light, power, water, compressed air, expendable tools and supplies. Grinnell shops have large storage areas for pipe and completed assemblies, expensive modern equipment,  a permanent staff of skilled workers. Grinnell finances material inventories and payrolls; carries insurance. The customer pays for no waste material or spoilage. Shop fabricated piping is rigidly inspected and tested to meet exacting requirements of customer's specifications and applicable codes. It is cleaned inside and outside and painted. Squared to standard dimensional tolerances, sub-assemblies are erected at the job site more quickly and easily. It all adds up to this . . . shop fabrication by Grinnell guarantees quality and economy.

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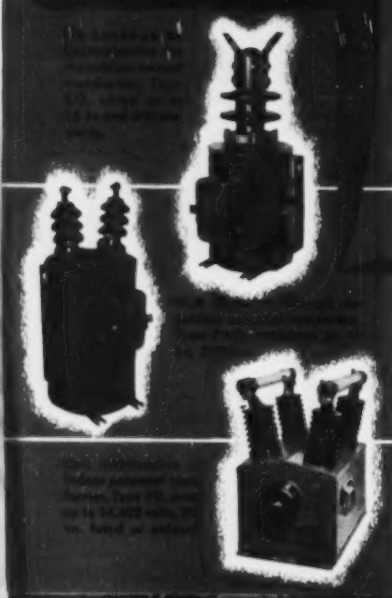

no leaks or contamination

with this Vacuum-Pressure Process

Allis-Chalmers Vacuum-Pressure System for Compound Filling Instrument Transformers Boosts Safety Factor and Virtually Eliminates Maintenance.

HERE'S AN ALLIS-CHALMERS "extra" that can save you money every day and add years of service to your instrument transformer.

It's the modern A-C vacuum-pressure solid-compound process. In addition to locking out air and moisture, it practically does away with transformer maintenance.

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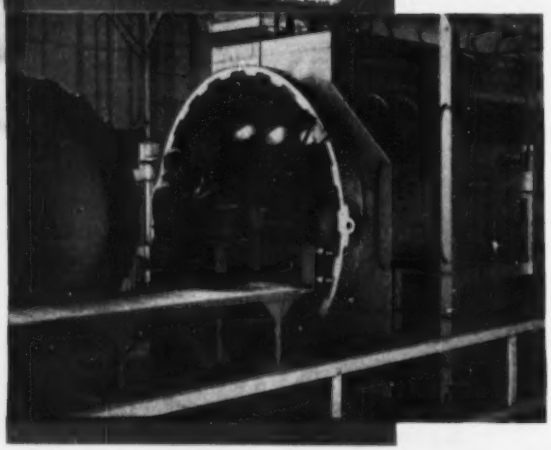

Solid compound used in the process is chemically stable, has high dielectric strength and is completely free of absorbed gases and impurities. It stops leakage and contamination.

You'll find Allis-Chalmers vacuum-pressure compound-filled units are a sound investment in accuracy and economy. As thousands of users find, they eliminate testing and filtering oil and greatly reduce periodic inspection.

It's easy to see how the benefits of compound-impregnating process will save you money, can save you trouble. Why not contact your nearby A-C district office for more information today. Or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3833

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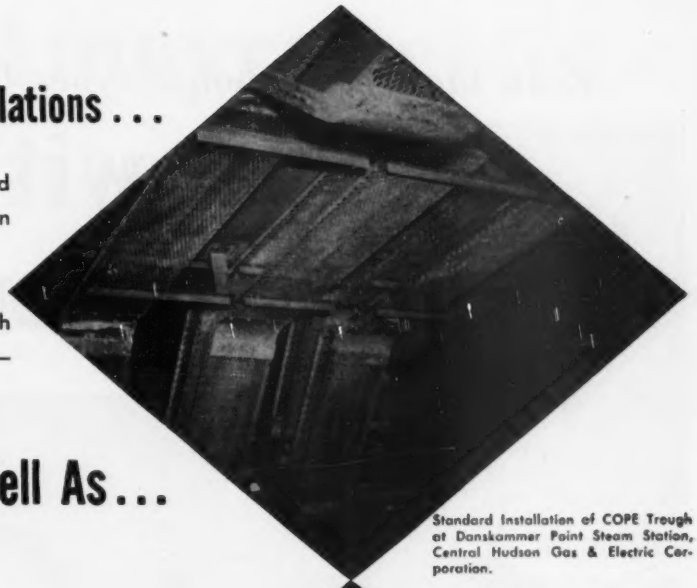

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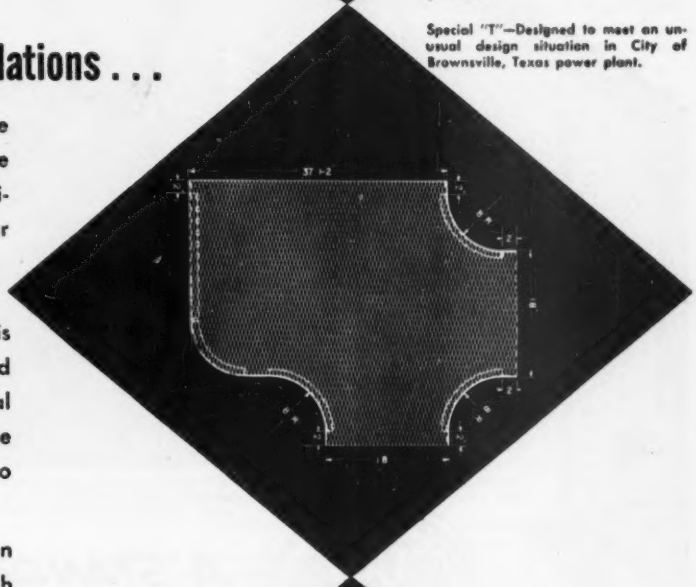

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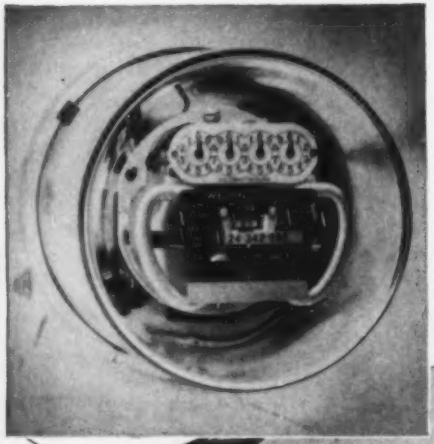

The entire electromagnet was immersed in brine for 3 months. Here it is after being removed. The U·S·S AMPYROL was completely unaffected, and easily withstood the 12,000 volt breakdown test.

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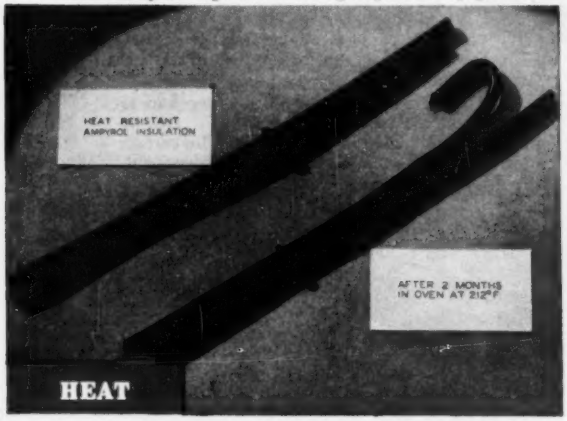
U·S·S Ampyrol coils 12 kv breakdown test months in salt water!

EVERY watt-hour meter is literally a "cash register" for some power company. As such, it must be extremely accurate.

The Westinghouse meter shown here remains accurate for years—mostly because of an engineering program that continually searches for ways to make the meters even *more* accurate while remaining unattended and exposed to the elements for years on end. For example: Westinghouse pioneered the ball and sapphire bearing, and practically eliminated a major source of wear. They even go so far as to *gold plate* every gear in the gear train, so that they will not corrode and slow down the meter.



Two months at 212°F. had no affect on U·S·S AMPYROL. When removed, the insulation passed all physical and electrical tests.

Now, Westinghouse has taken another major step forward in design by switching to U·S·S AMPYROL for the important current winding in these watt-hour meters.

American Steel & Wire engineers worked closely with Westinghouse, and developed a special non-fogging polyvinyl insulation that has excellent electrical and physical properties; yet it will not give off fumes that cloud the meter glass. As part of a rigorous test procedure, Westinghouse engineers immersed the entire electromagnet in a brine solution for 3 months. After removal, the AMPYROL wire easily withstood a 12,000 volt breakdown test. In another test, AMPYROL was held in an oven at 212°F. for 2 months. When removed, it was just as good as new and tested perfectly.

The full range of tests showed that U·S·S AMPYROL would eliminate leakage current due to faulty insulation, thereby assuring long range meter accuracy.

How has this insulation actually stood up in service? Hundreds of thousands of AMPYROL equipped meters are now in service; and the insulation is performing perfectly despite the moisture, industrial fumes, salt air, ultra-violet rays from the sun and extreme heat and cold.

• • •

This is just one of many uses for U·S·S AMPYROL. It is widely used for re-wiring old buildings because the thin jacket allows more wire to be pulled through the same size conduit. AMPYROL is an important part of many machine tools because it strips clean, is available in many brilliant colors to simplify installation, and is unaffected by cutting oils and grease. AMPYROL is even used for exposed electric sign wiring because rain, sun and cold do not affect it.

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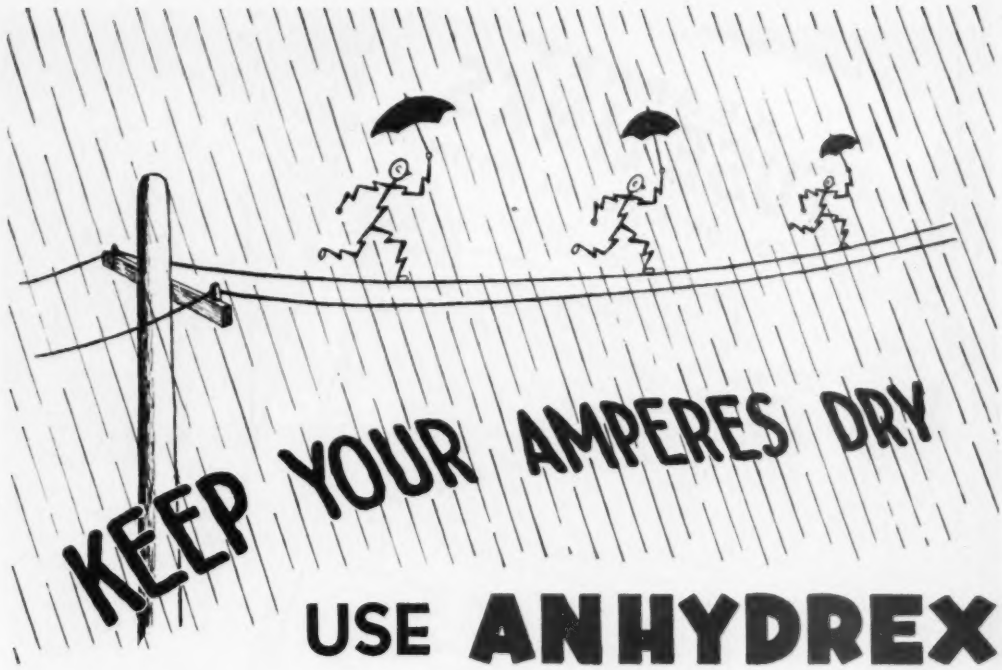

KEEP YOUR AMPERES DRY

USE ANHYDREX

Water in some form or other causes more interference with satisfactory cable service than any other one thing. Even small amounts of moisture finding their way into cables can put important power circuits out of business.

Cables in ducts are nearly always exposed to water. Even aerial cables can suffer from water. That is why you should use ANHYDREX cables to keep your amperes dry. With Simplex Anhydrex rubber insulation you need not use a lead sheath. ANHYDREX cables will function satisfactorily even under the wettest conditions.

You can avoid cable troubles on your important network and feeder circuits by using Simplex Anhydrex insulation on your cables. In that way you assure yourself that your amperes will always be dry. If you would like to know more about this dependable, long-lived insulation, simply send a request to the address below.

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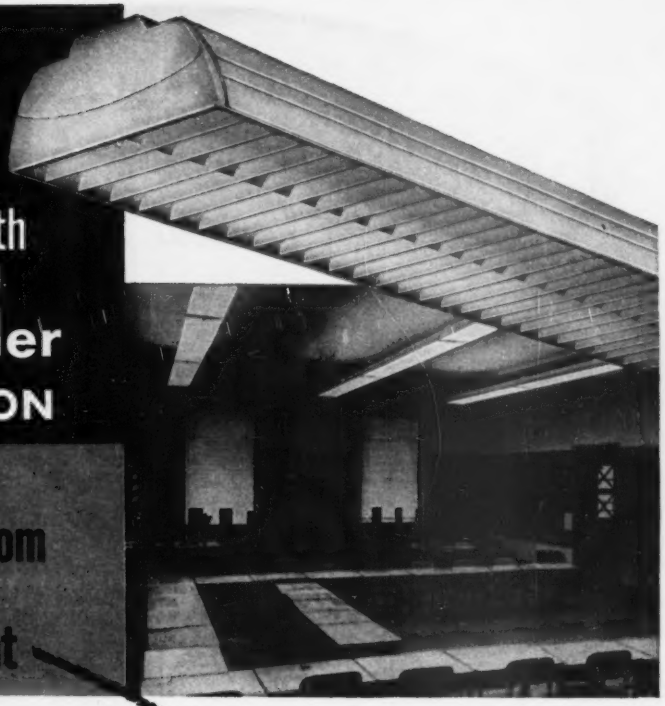
FUSE LINKS
DESIGNED FOR ACCURATE SYSTEM-WIDE COORDINATION
FUSE coordination today is much more than a convenience. It is a dollar-and-cents necessity. Increased loads . . . increased operating costs demand service continuity. Kearney Fuse Links are the industry's standard. They lead the field in sales because of proved performance, better coordination with reclosers, sectionalizers and other fuses. Extreme time-current accuracy is made possible by field-tested design plus dependable low temperature characteristics of the pure tin elements.
Look at your records. If you have been dropping loads, tripping station breakers, damaging equipment . . . losing revenue needlessly because of faulty fuse coordination, it is time to switch to Kearney. Write today for complete curves and data on all the Kearney Fuse Links. They are the answer to better operation tomorrow.
JAMES R. KEARNEY CORPORATION
4224-42 CLAYTON AVE., ST. LOUIS 10, MO.
Canadian Plant, Guelph, Ontario
JAMES R. KEARNEY
The Mark of Quality Products
FOR THE RIGHT LINK AT THE RIGHT PLACE AT THE RIGHT TIME
Install KEARNEY FUSE LINK DISPENSER
25 KEARNEY FUSE LINKS
TYPE KS FITALL CARD
STANDARD PACKAGE 25 FUSE LINKS
10 AMP.
10 AMP.
209
Kearney Products
FOR BETTER CONSTRUCTION—SAFER MAINTENANCE

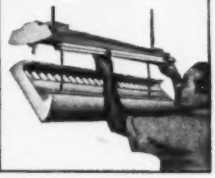
school-lighting dollars buy more with the new miller LEXINGTON



you get better classroom lighting at

EASY, QUICK INSTALLATION

ECONOMICAL MAINTENANCE



EXTREMELY LOW BRIGHTNESS

L.O.C.*

You get CLASSROOM LIGHTING** of extremely low brightness, with high efficiency — improved lighting performance — at **L. O. C.

***You get EASY, QUICK INSTALLATION:** completely-wired 8′ channel — fewer parts to handle — fewer supports from ceiling — sliding clamp hanger grips flanged top, to simplify mounting.*

***You get ECONOMICAL MAINTENANCE:** the LEXINGTON can be relamped 3 ways from one ladder position.*

***You get LONG, USEFUL LIFE:** rigidized steel construction — steel rust-protected by 5-stage Bonderite process — hot sprayed-high baked white enamel long-life finish.*

You get MORE VALUE FOR YOUR LIGHTING DOLLARS.

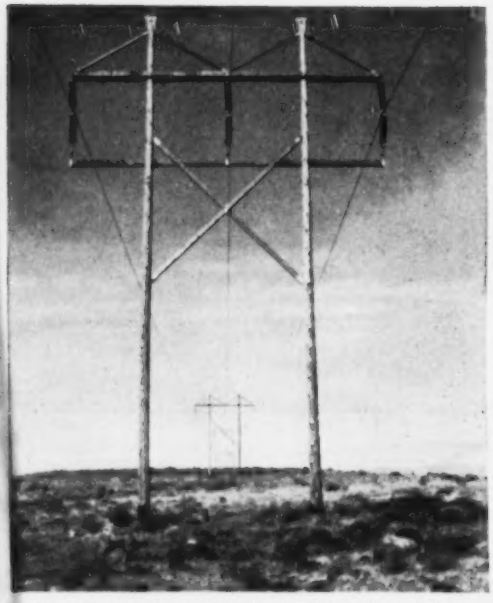
*Write for Miller LEXINGTON and **L. O. C.** folder. Miller field engineers and distributors are conveniently located for nation-wide service.*

***Low Overall Cost**

THE miller COMPANY MERIDEN, CONN.
SINCE 1844

Demand PROOF OF PERFORMANCE

for Locations like these

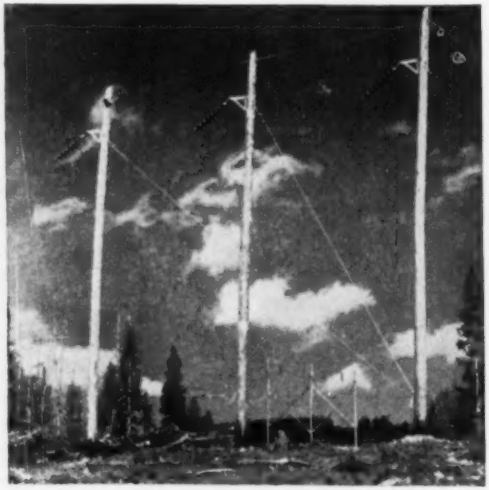


Thomas Insulators make certain that this 230-kv hold-down structure will give satisfactory service for decades to come.

"Where the going is rough . . . where trouble-free performance is a must . . . that's where Thomas *superior insulator quality* really pays off."

Shown on this page are just two of the many Thomas installations on the lines of a large Western Utility. For many years, this Customer has given us order after order. Such *repeat orders* from this and other companies are the best testimonials to the long life and outstanding performance of Thomas Insulators.

After all is said . . . it's still quality that counts plus proper designing, precision manufacturing . . . and PROOF OF PERFORMANCE. Throughout the world, Thomas Insulators have been establishing service records since the advent of the Electrical Industry. Why gamble?



For this 69-kv medium-angle structure, Thomas Insulators have the stamina that assures long life and trouble-free performance.

The R. Thomas and Sons Company is a manufacturer and designer of all types of porcelain insulators . . . pin-type, switch, suspension, spools, guy-strain, bushings and special high-voltage porcelain. In addition, Thomas supplies associated line hardware, clamps, fittings, preformed armor rods, and so on.

SPECIFY THOMAS INSULATORS—THE BEST BY LINE TEST

— Since 1873 —

The R. Thomas and Sons Co.

1873 THOMAS INSULATORS RELIABILITY 79th year 1952

LISBON, OHIO

NEW YORK CHICAGO

Sales Representatives: C. G. Anderson, *Chicago* • **E. B. Anderson Co.,** *Detroit* • **Ken H. Best,** *Seattle* • **R. E. Cunningham & Son,** *Los Angeles* **W. H. Eddy Products Co.,** *Phoenix, Ariz.* • **Engineer Sales Corp.,** *St. Petersburg* • **R. F. Hamilton & Associates,** *Denver* • **Geo. E. Honn Company,** *San Francisco* • **W. J. Hugo,** *Minneapolis* • **Leiser & Company,** *Philadelphia* • **John G. Pettijohn Company,** *Knoxville* • **H. E. Ransford Co.,** *Pittsburgh* • **J. F. Schaefer & Co.,** *Kansas City* • **R. J. Sullivan & Company,** *Boston* • **Tafel Electric & Supply Co.,** *Louisville* • **Walter E. Thompson,** *Birmingham* • **Triangle Electric Supply Company,** *El Paso* • **United Electric Supply Co.,** *Salt Lake City* • **Williamson Sales Co.,** *Shreveport, Amarillo, Dallas, Houston, New Orleans, Pine Bluff* • *Representatives in other principal cities*

What to look for in a safety switch

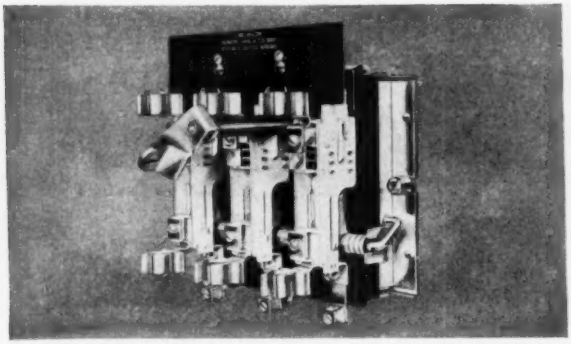
- **Maximum protection for electric circuits and personnel**
- **Ease and flexibility of installation**
- **Convenient and safe maintenance**

A modern, top quality, heavy-duty industrial safety switch *should* fulfill these requirements . . . but what are the design and construction features that make certain that it *will?*

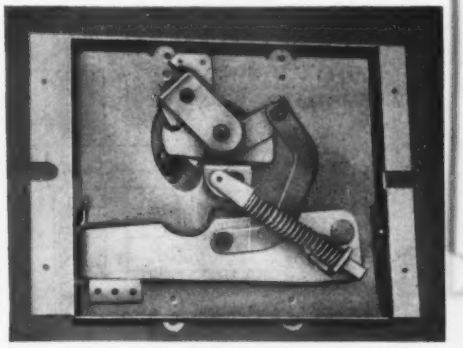
Let's take a close look at the front-operated HCI switch*—Trumbull's best—and check its features point by point.

**Meets NEMA types I and IA specifications.*

1. START ON THE OUTSIDE—*THE ENCLOSURE.* Made of heavy gauge steel, specially treated and then coated with high-baked enamel for corrosion resistance. That *handle* is important, too. It has a releasable interlock for use of authorized inspectors only and will take three padlocks. The *cover latch* may be locked independent of the handle so the switch can be operated but not tampered with. The front is provided with a gasket, making the enclosure semi-dust-tight. Inside there's ample room for wiring—and plenty of *knockouts.* Three mounting holes make possible easy leveling and allow mounting on uneven surfaces.



2. REMOVE THE *INTERIOR UNIT.* Just loosen two screws and the whole interior slips out. The *pole units* are self-contained for easy removal without disconnecting wiring and use *silver-plated current-carrying parts . . . arc-resisting, linen-melamine insulating parts.* U-shaped *movable conductors* bring gap between line and load contacts to less than ½ inch reducing possibility of arc damage. Exclusive design of *pole units* and *contacts* take advantage of magnetic repulsion principle to give maximum arc-quench and contact bind (look further into this feature; it's the key to the long life expectancy of the Trumbull HCI).



3. BE SURE TO STUDY *OPERATING MECHANISM.* Underside of the HCI interior shows this operating mechanism which is protected by a riveted *cover plate.* It uses a *roller-cam action* and a multiplying *linkage* design with a powerful *spring* that always throws to full OFF or ON. No halfway position because there's no dead center.

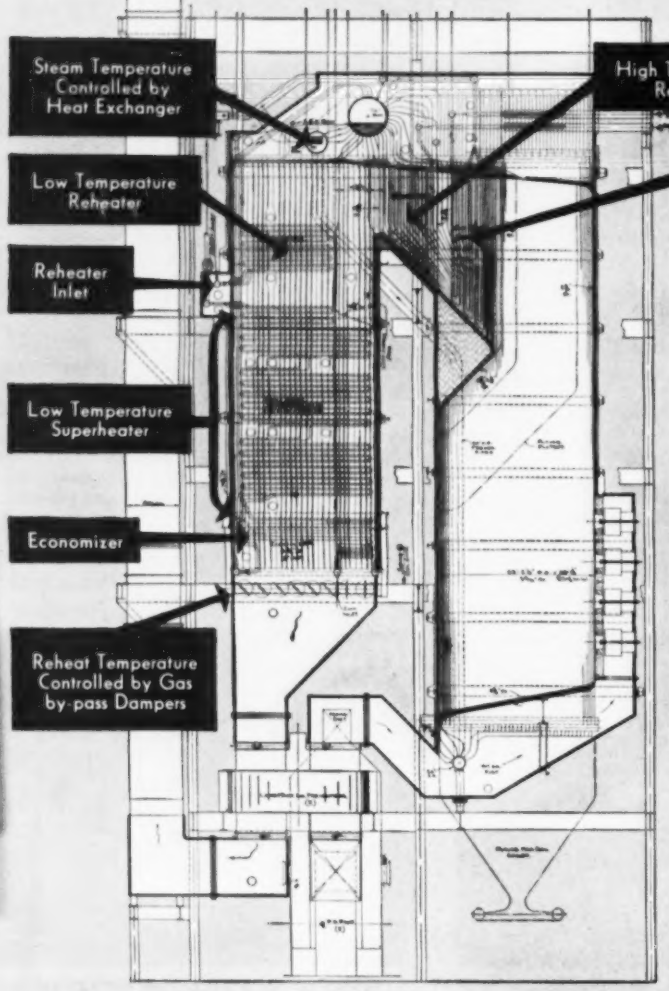
Write for full data on Trumbull top quality, heavy-duty industrial safety-switch line—the HCI. Ask for Bulletin TEC-10.

TRUMBULL ELECTRIC

DEPARTMENT OF GENERAL ELECTRIC COMPANY

PLAINVILLE, CONN.

Louisiana Power & Light



DESIGN DATA

Capacity
1,000,000 lbs./hr.

Pressure
Design—1725 psig

Operating
Super Outlet—1575 psig
Reheat Outlet—470 psig

Temperature
Superheater—1005°F.
Reheater—1005°F.

Efficiency
Oil
@1,000,000 lbs./hr. 88.1%
Gas
@1,000,000 lbs./hr. 84.2%

Ebasco Services, *Engineers*

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Charlotte · Atlanta · New Orleans · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

BOILERS · PULVERIZERS · BURNERS · STOKERS · SUPERHEATERS · ECONOMIZERS

first to use Reheat with Natural Gas

Louisiana Power & Light Company's 1,000,000 lbs./hr. pressure furnace Riley Reheat Unit will be the first reheat unit fired by natural gas and oil to be installed by the Public Utility industry.

Several features of Riley Unit for Louisiana Power & Light Company

Separate Independent Control of Superheater and Reheater Temperatures.

Maintenance of desired superheater and reheater steam temperatures is obtained by different and independent controls so that an adjustment to the temperature of one does not effect the final temperature of the other. Reheater temperature is controlled by varying the quantity of gas passing over the low temperature reheater sections by means of dampers beyond the economizer. Superheater temperature is controlled by means of a heat exchanger which regulates the temperature of steam entering the high temperature superheater section so as to give the desired superheater outlet temperature over the desired load range.

All Tubes Welded to Stub Tubes. *No Rolled Joints.*

All tube connections to drums and headers of boiler, water walls, superheater and economizer are welded, not rolled and merely seal welded. Stub tubes are shop welded into drums and headers prior to shipment for field weld of tubes thereto.

Furnace Pressurized. *No Induced Draft Fans.*

The unit is a pressurized furnace unit operating with forced draft fans only. The furnace will operate under a pressure of approximately 7.25" of water. The use of a pressurized furnace reduces over-all fan power requirements and increases efficiency because of lower excess air.

A Few Recent Riley Units for Public Utility Plants

DEPARTMENT OF WATER AND POWER
CITY OF LOS ANGELES, CALIFORNIA
1,200,000 lbs./hr. 2075 psig, 1000°F. and 1000°F. reheat.

LOUISIANA POWER & LIGHT CO.
1,000,000 lbs./hr. 1725 psig, 1005°F. and 1005°F. reheat.
Ebasco Services, *Engineers*

HOUSTON LIGHTING & POWER CO.
1,200,000 lbs./hr. 1700 psig, 1005°F.
Ebasco Services, *Engineers*

SOUTHWESTERN GAS & ELECTRIC CO.
630,000 lbs./hr. 1050 psig, 1005°F.
Sargent & Lundy, *Engineers*

MONONGAHELA POWER CO.
700,000 lbs./hr. 1050 psig, 905°F.
Sanderson & Porter, *Engineers*

UTAH POWER & LIGHT CO.
575,000 lbs./hr. 1700 psig, 1000°F. and 1000°F. reheat.
Bechtel Corp., *Engineers*

CENTRAL ILLINOIS LIGHT CO.
600,000 lbs./hr. 950 psig, 900°F.
Commonwealth Services, *Engineers*

NORTHERN STATES POWER CO.
385,000 lbs./hr. 1500 psig, 950°F.
Pioneer Service & Engineering, *Engineer*

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY
460,000 lbs./hr. 1025 psig, 900°F.
Ford, Bacon & Davis, *Engineers*

THE POTOMAC EDISON CO.
700,000 lbs./hr. 1050 psig, 905°F.
Sanderson & Porter, *Engineers*

IOWA ELECTRIC LIGHT & POWER CO.
300,000 lbs./hr. 975 psig, 910°F.

GULF POWER CO.
325,000 lbs./hr. 1000 psig, 900°F.
Southern Services, *Engineers*

SOUTH CAROLINA GAS & ELECTRIC CO.
400,000 lbs./hr. 1475 psig, 955°F.
Gilbert Associates, *Engineers*

UTAH POWER & LIGHT CO.
620,000 lbs./hr. 1500 psig, 955°F.
Bechtel Corp., *Engineers*

IOWA-ILLINOIS GAS & ELECTRIC CO.
250,000 lbs./hr. 975 psig, 905°F.

PUBLIC SERVICE CO. OF INDIANA
400,000 lbs./hr. 1000 psig, 910°F.
Sargent & Lundy, *Engineers*

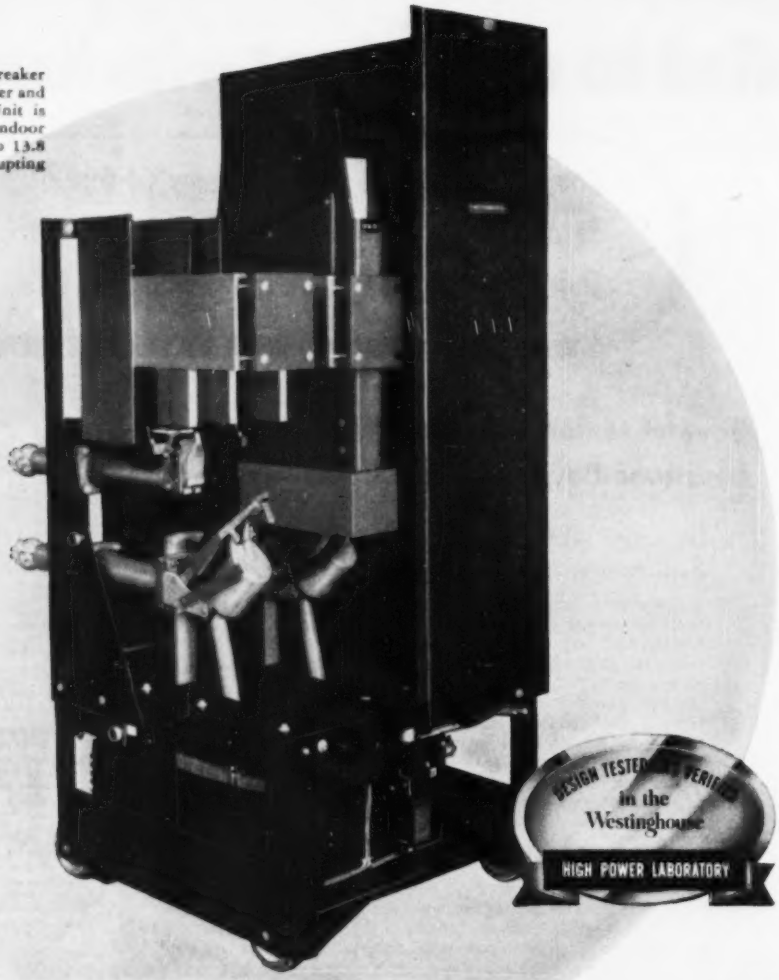
A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

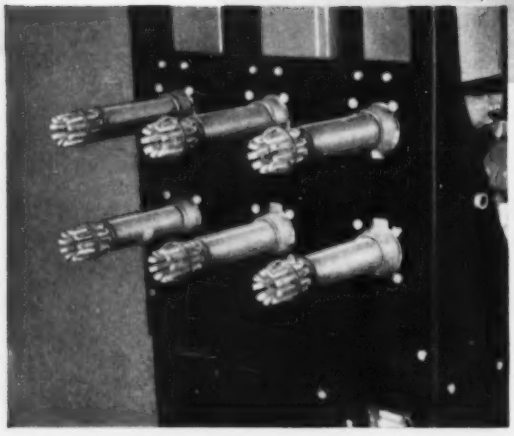
COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

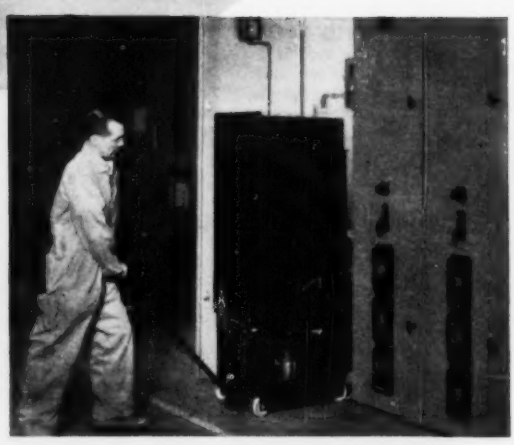
WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

150-DH-250 Air Circuit Breaker with half of interphase barrier and one arc chute removed. Unit is horizontal drawout—for indoor and outdoor service 4.16 to 13.8 kv—150 to 500-mva interrupting rating.





Positive contact is obtained on primary disconnects by individual flat springs and heavily silvered, self-aligning, finger-like segments. Segments on breaker are easy to inspect.



Horizontal-drawout feature makes it easy to place breaker into operation. Two-surface wheels which ride on track in stationary structure assure perfect alignment for engaging contacts.

The DH De-ion® breaker design pays performance benefits

IN EVERY PHASE OF METAL-CLAD SWITCHGEAR OPERATION!

Here's how the Westinghouse DH Air Circuit Breaker for Metal-Clad Switchgear gives you the kind of performance you want . . .

Fast, positive, arc interruption . . . DH Air Circuit Breakers employ the De-ion® principle of arc interruption—the most efficient method of arc extinction in use today. The De-ion principle is a Westinghouse exclusive! The true ceramic material used in constructing the arc chutes provides unusually high resistance to heat shock.

Simple, effortless operation . . . DH Breakers are the horizontal-drawout type. No lowering or lifting is necessary. There's no complicated mechanism to require frequent inspection or maintenance. Breakers are drawn straight out from disconnected position . . . require only a few easy turns of a crank to move into operating position.

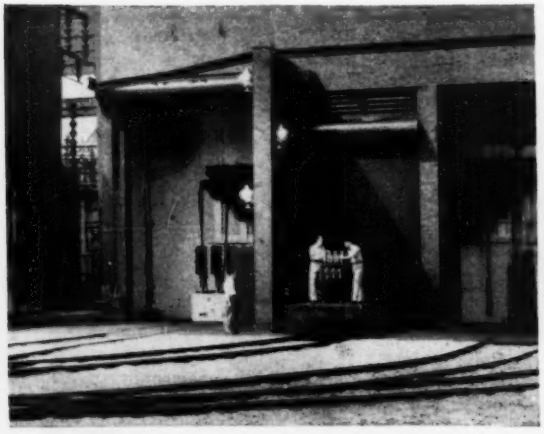
Easy inspection and maintenance . . . Breaker interphase barriers can be removed by simply loosening holding bolts. Arc chute removal—just as simple—exposes contacts at an accessible and convenient working height for quick inspection and maintenance. High-pressure, finger segments located on breaker primary disconnects further simplify maintenance.

"Long-life" construction . . . All breaker elements are secured to a rigid, all-welded steel frame. Hardened, stainless steel is used at major wearing points . . . silver-tungsten arcing contacts have high resistance to arc burning.

Perfect alignment for interchangeability . . . The use of a master breaker and a master stationary structure in manufacturing holds drawout units and stationary structures to close dimensional tolerances. Result is perfect alignment . . . easy interchangeability.

Proved operation . . . The DH Air Circuit Breaker design has been extensively tested in the Westinghouse High Power Laboratory. The results of these tests are verified by many years of satisfactory field performance on thousands of breakers.

For complete information on Westinghouse Metal-Clad Switchgear write for Booklet B-5306. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60795



A DH Air Circuit Breaker is brought into a test cell in the Westinghouse High Power Laboratory to verify new design feature under short-circuit conditions.

See "Electrical Proving Ground"

. . . the dramatic story of the Westinghouse High Power Laboratory in sound and color motion picture. For details see your Westinghouse representative, or write: Westinghouse Film Division, Box 868, Pittsburgh 30, Pennsylvania.

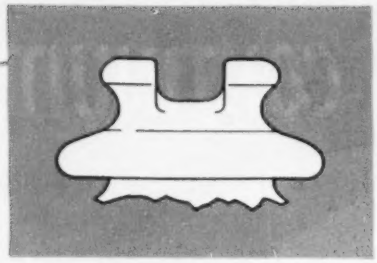
ELECTRICAL PROVING GROUND

YOU CAN BE SURE . . . IF IT'S

Westinghouse

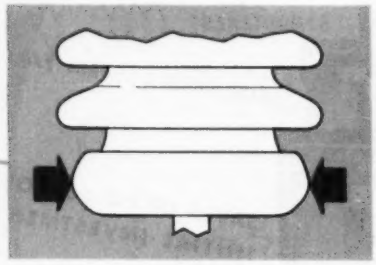
METAL-CLAD SWITCHGEAR

Lapp LINE POST



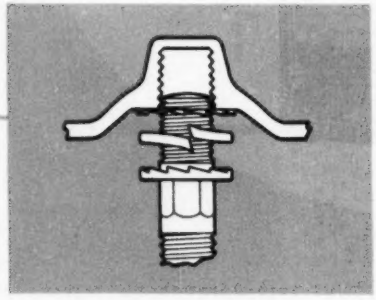
LARGER CONDUCTOR GROOVES

Improved wider square-side top-grooves—conforming to new EEI-NEMA standards—provides for conductor of any diameter up to 1½". Holds conductor in top groove turning angles up to 15° (30° by using two insulators). With 45-Kv and smaller Line Posts, sharper angles may be turned by using side groove for conductor.



HARDWARE EXTERNALLY ATTACHED

Porcelain is approximately five times as strong in compression as in tension. In the Lapp Post design there are no nested porcelain parts or metal inserts which can load the porcelain in tension—or with any high-intensity local stresses. Hardware attachment is a cemented-on base, providing the safety of a large area, low-intensity compression grip.

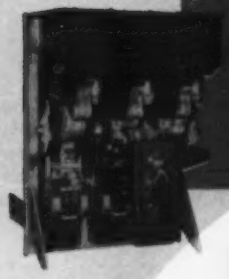


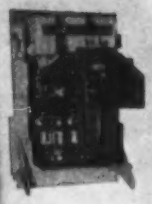
INTERCHANGEABLE STUD BOLTS

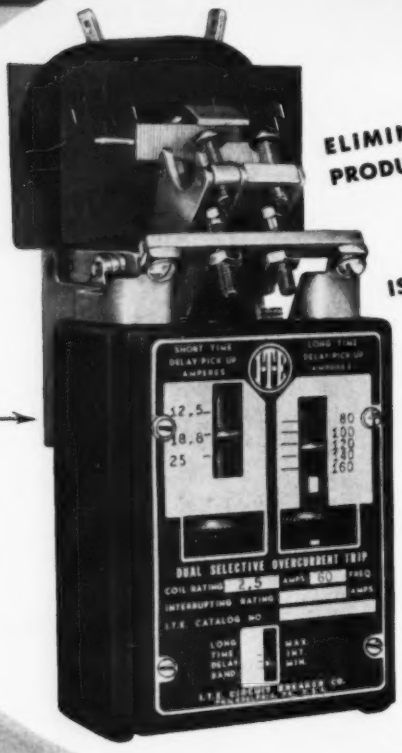
Stocking problems are reduced with the Lapp Line Post. Separable 7" (for wood cross arms) or 1¾" (for metal mounting) studs—or special lengths on order—are interchangeable for all units, and may be installed in the field. Serrated surfaces in the base and stud flange engage a "positive" lock washer—when the stud is tightened into the base a vibration-proof attachment is assured.

LAPP INSULATOR CO., INC., LE ROY, N.Y.

SERVICE CONTINUITY







ELIMINATES COSTLY PRODUCTION BREAKDOWNS

ISOLATES SYSTEM FAULTS

SAVES UP TO 63% ON INITIAL INVESTMENT

Direct-Acting Selective Overcurrent Trip Devices are available for I-T-E KA, KB, KC, and LG type circuit breakers in the following ratings:

15,000 to 100,000 amperes interrupting capacity

100 to 6000 amperes continuous

MODERN I-T-E DIRECT-ACTING SELECTIVE TRIP BREAKER PROTECTION

It's easy to protect production and profits against disastrous total power failure in complex electrical distribution systems. The cost is lower than you think.

Modern Selective Tripping—pioneered and developed by I-T-E—eliminates the failings of inadequate systems which can tie up an entire plant or utility with a single short somewhere along the line.

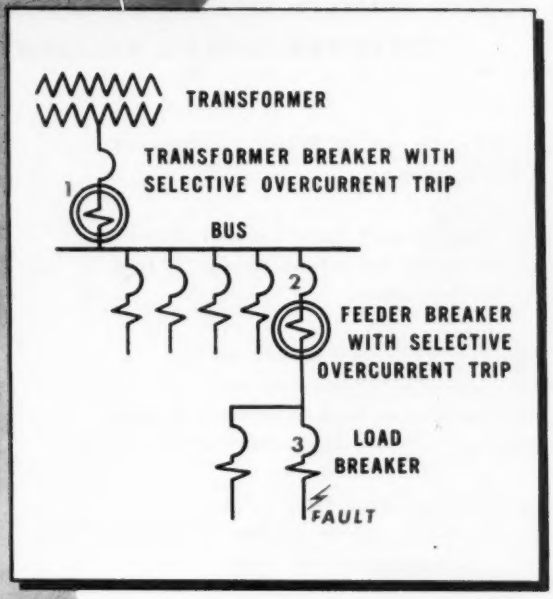
Selective Tripping limits the fault to *one* affected area only. Production continues—*uninterrupted*—throughout the rest of the system.

I-T-E TRIP DEVICE SAVES 63% ON INVESTMENT

Secret of this efficient delayed-action circuit breaker protection is the I-T-E *Direct-Acting* Selective Overcurrent Trip Device. Developed by I-T-E engineers to replace complex, expensive transformer-relay auxiliary apparatus, this unique tripping device gives one more reason for I-T-E leadership in the design and application of quality circuit breakers and switchgear.

Positive—compact—dependable, the low-cost I-T-E Trip Device saves you up to 63% on accessory cost per circuit! And because it is a *direct-acting* device—an integral part of the circuit breaker—no additional space is required on your switchboard panel. Assure service continuity. Install I-T-E Selective Tripping in *your* plant.

COSTS LESS THAN YOU THINK



HOW SELECTIVE TRIPPING WORKS

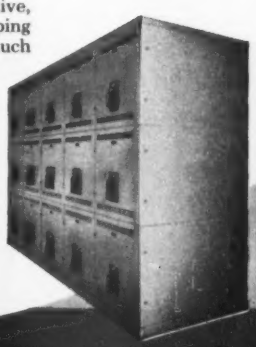
I-T-E circuit breakers, arranged in series, are *preset* to open in *definite sequence* (3, 2, 1 in diagram). If there is a sudden overcurrent or short circuit in any branch of the system, only the breaker (3) closest to the fault will open. Other breakers—other production machinery—in the system are unaffected.

ANOTHER I-T-E "FIRST"

Here is one more I-T-E "first"—another major I-T-E development to help industry protect production and save. Originally developed for the Navy during the War, the I-T-E Direct-Acting Selective Overcurrent Tripping Device has since been refined and perfected for industrial and utility use.

Call on I-T-E engineers—specialists in circuit breakers and switchgear—to see how positive, dependable I-T-E *Direct-Acting* Selective Tripping can protect your plant operation. See how much you can save.

For selection and application data on I-T-E large air circuit breakers, including selective tripping arrangements write for Catalog Section 1003 today. I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Phila. 30, Pa.



I-T-E

LOW-VOLTAGE SWITCHGEAR

I-T-E CIRCUIT BREAKER CO. • 19TH AND HAMILTON STS. • PHILADELPHIA 30, PA.

CANADIAN MFG. AND SALES: EASTERN POWER DEVICES, LTD., TORONTO • EXPORT SALES: PHILIPS EXPORT CORP., N. Y. 17, N. Y.

STEAM POWER for Kaiser

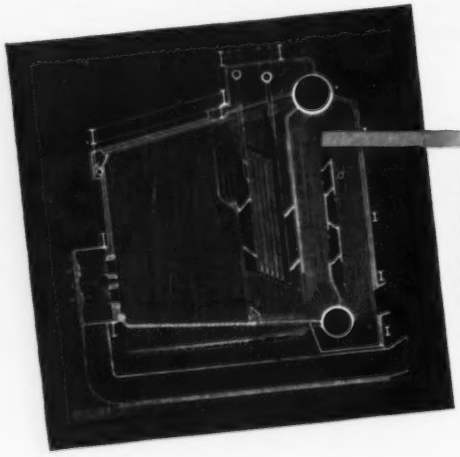
15 FOSTER WHEELER STEAM GENERATORS SERVE THE SOUTH'S BIG NEW

For every pound of aluminum produced in this new 400,000,000 pound-per-year plant, Kaiser will need about 10 kwh of electric power.

To meet this enormous, almost constant demand, Kaiser Engineers selected a plant consisting of gas-burning radial engines, and 15 Foster Wheeler "D" type boilers to supply steam for the turbine-generators.

These boilers, with a combined capacity of 3,375,000 lb of steam per hr, are ideally suited to Kaiser's requirements for reliability, ease of operation and high availability. And they are a natural for use in the South where a temperate climate permits low-cost, semi-outdoor-type installations.

This installation is another example of Foster Wheeler's ability to design and construct power-producing equipment to meet the needs of industry.



Cross-section of one of the 15 duplicate Foster Wheeler "D" type steam generators for Kaiser Aluminum. The regenerative air heater is not shown.

CAPACITY	225,000 lb per hr
PRESSURE	900 psig
FINAL STEAM TEMPERATURE	905 F
TEMPERATURE FEEDWATER INLET	350 F
FIRING	Natural Gas

For information on your steam generation

Aluminum

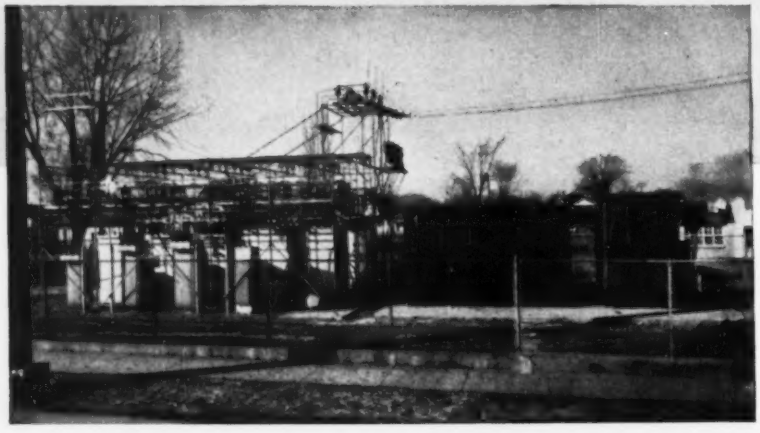
INDUSTRY AT CHALMETTE, LA.

Aerial view showing first six boilers and six of the eight stacks under construction. Nine more boilers, now being fabricated, will be located in extension of the present line. Turbine room is to the left.

requirements, write to: **FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK 6, NEW YORK**

FOSTER WHEELER

A 3,000-kva unit substation located in the same lot with a 1,500-kva substation of the open conventional design. The open-type equipment was later removed.



Midwest utility modernizes system, solves load problem

WITH WESTINGHOUSE UNIT SUBSTATIONS

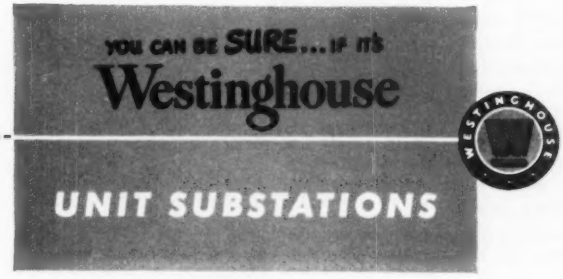
The experience of Iowa-Illinois Gas & Electric Company with unit-type substations will interest progressive system planners. It suggests a way to attain this important objective: *a simplified flexible system providing long-range operating economies.*

"Load growth in our area made it imperative for us to modernize our distribution system. After considerable study it was decided to use factory-built, unit-type substations.

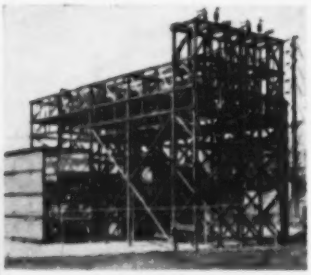
"Westinghouse Unit Substations of co-ordinated unit design met our requirements . . . maintenance has been very slight . . . location of the substations close to the load center keeps losses to a low value and provides for better regulation. Future expansion is simply and economically handled by adding unit substations in areas of maximum load growth —or by moving a substation in its entirety, if load shifts, thereby salvaging the bulk of the investment."

Iowa-Illinois Gas & Electric enjoys these benefits because Westinghouse Unit Substations are specifically designed to meet today's power distribution problems. Unitized construction simplifies expansion to accommodate increased load requirements. Individual feeder regulation can often be eliminated and Westinghouse Unit Substations offer these same advantages to you.

For complete information, get your copy of Booklet B-4061. Ask your Westinghouse Representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60779



FIELD PERFORMANCE RECORDS



ENGINEERING NOTES...

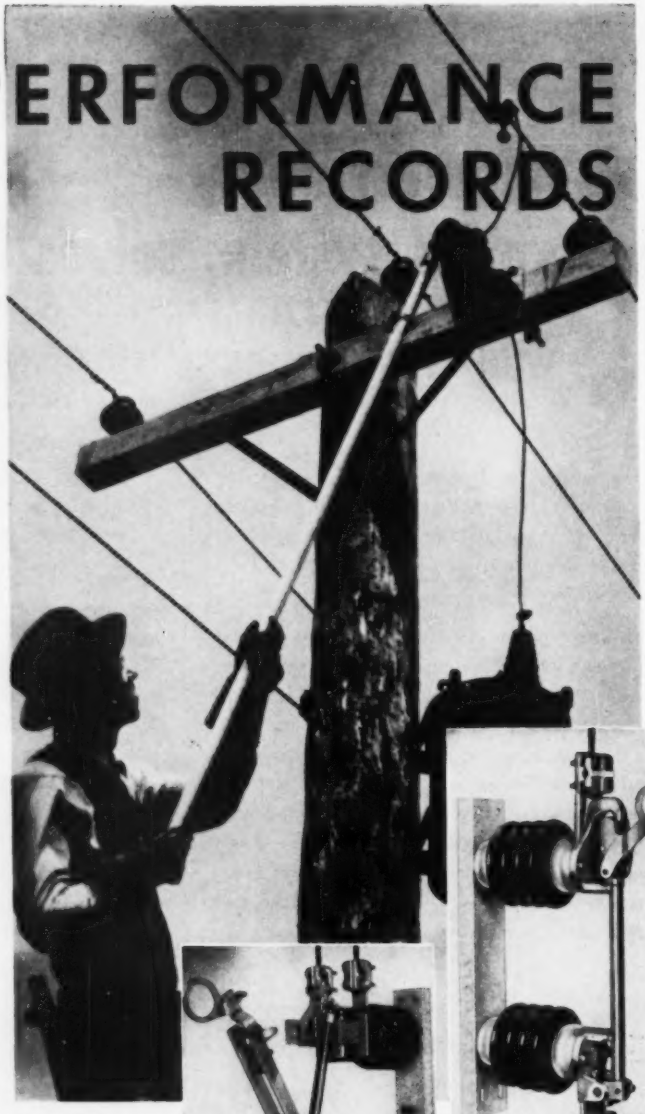
Electronic Switch Triggers Tests At Kearney Substation Laboratory

POWER follow current is initiated in lightning arresters and fuse cutouts by an electronic circuit at our test substation. Designed and built by Kearney engineers this switch enables them to start follow current at any desired point on the line voltage wave within the range of 10° to 170° positive or negative. Repeated shots on specified points of the wave provide exacting tests of equipment operation.

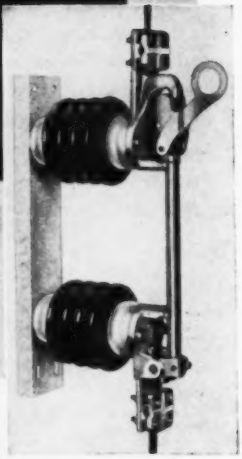
Oversimplified, the circuit consists of a pulse activated Thyratron which fires a surge generator automatically. An R-C circuit selects the proper phase relationship with the substation supply voltage and feeds a limiter stage. The square wave output of this amplifier is then differentiated into pips. These steep pulses are impressed on the normally negative grid of the Thyratron. A manually operated relay removes the negative cut-off voltage from the grid and the tube fires on the first positive pulse occurring thereafter, triggering the surge generator and starting the follow current.

When you specify Kearney Products you are getting the best equipment that exhaustive research, design study and test can produce for the power field.

-208



By pass voltage regulators safely and economically with this Kearney Regulator By-Pass Switch. Replaces three single pole hook operated switches formerly required for the job.



High conductivity current path through the Kearney Ultra High Pressure Disconnect Switch reduces operating temperature, cuts replacement costs.

KEARNEY

Prove the Value of KEARNEY PRODUCTS

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. GUELPH, ONT.

"The Mark of Quality Products"

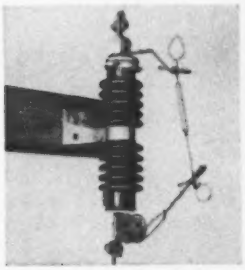
POSITIVE Performance; Sturdy Construction; Long, Hard Service ... these are the reasons why operating men prefer Kearney Equipment.

Protective equipment especially demands positive performance. The cutouts and oil switches shown on these pages have been engineered and field-tested for full range interrupting capacity. That's why they are standard with most of America's power companies.

Sturdy construction saves maintenance trips, increases profits for hundreds of operating utilities in thousands of locations. You can count on long, hard service from Kearney Equipment in all types of climates; in all types of atmospheres.

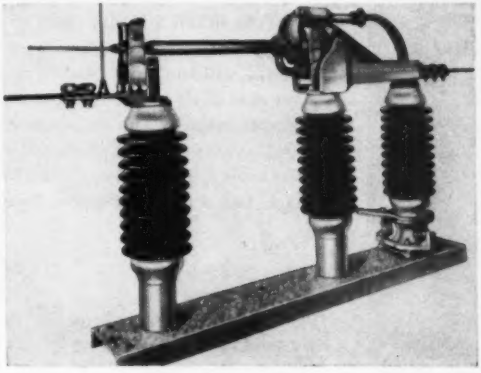
Write for complete technical information on these products. Compare feature for feature, value for value. See for yourself why more and more men in the field are specifying "All Kearney" on their orders.

JAMES R. KEARNEY CORPORATION
4224-42 CLAYTON AVE. • ST. LOUIS 10, MO.
Canadian Plant, Guelph, Ontario

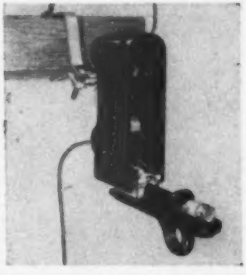


The Trip-O-Link, a Kearney invention has given 100% full load protection to rural lines for over 15 years.

Trip Outs provide reliable heavy-duty protection at sustained maximum load ratings without damage to cutout.

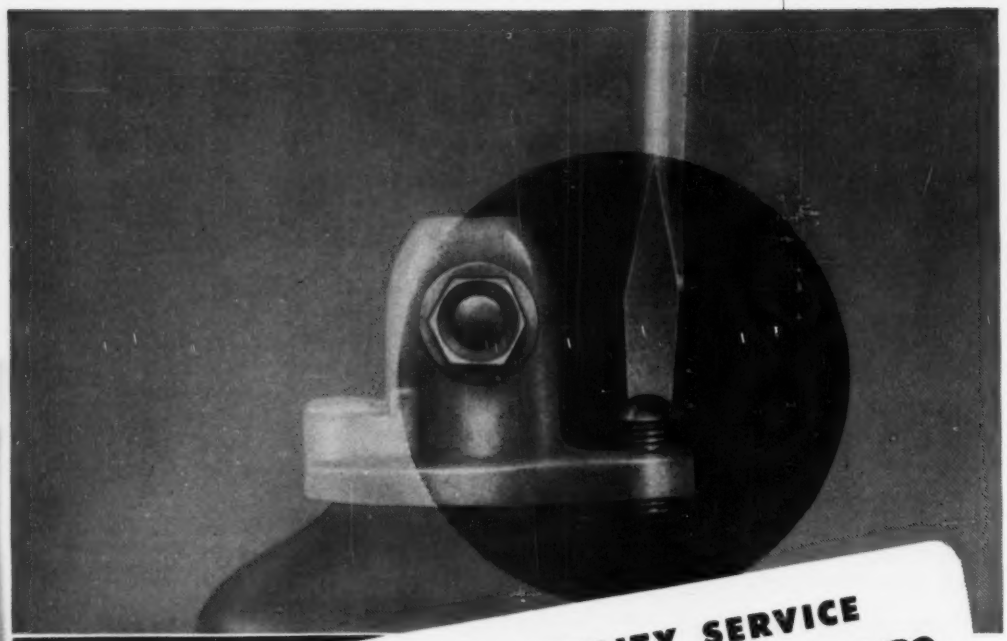


Kearney Group Operated Switches are made fully adjustable to compensate for shifts in mounting structure or play in interphase rod travel. Fully adjustable design adds years to normal switch life; cuts replacement cost. Beryllium copper spring contacts provide high pressure current transfer at both ends of blade for cooler operation. Oilite bearings align blades with contacts and allow full wiping action. Dependable, all-weather operating mechanism works smoothly whenever routine or trouble requires quick action.

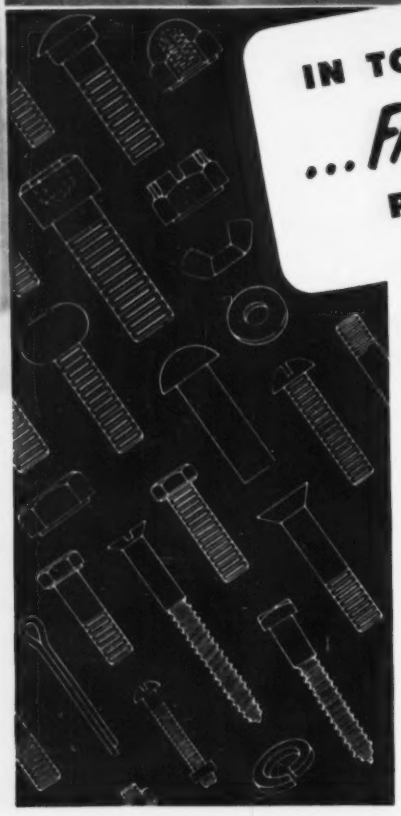


The Trip-O-Matic guards expensive distribution equipment; provides full protection for systems subject to widely varying city fault conditions.

PRODUCTS *for Better Construction Safer Maintenance*



IN TOUGH UTILITY SERVICE ... FASTENINGS by HARPER PREVENT CORROSION



Fastenings used by public utility companies must stand up under tough service conditions—in all kinds of weather.

Harper Everlasting Fastenings are designed to withstand these severe conditions and give years of trouble-free service.

In the complete Harper line there are more than 7,000 items. Here you will find bolts, nuts, screws, rivets, studs, washers, and cotter pins of all non-ferrous metals and all stainless steels.

Harper metallurgists and engineers will gladly assist you in the solution of any fastening problem you may be facing.

For better fastenings, call The H. M. Harper Company, 8205 Lehigh Avenue, Morton Grove, Illinois.

There is a Harper distributor near you with stocks of fastenings ready to fill your order. Call him for prompt service.

HARPER

EVERLASTING FASTENINGS

Specialists in all non-corrosive metals

BECHTEL

ALL THE WAY...

Plan to Plant

Placing the entire job with Bechtel—**design, procurement and construction**—assures a plant fully meeting predetermined requirements, in operation at the earliest possible moment.

This is being demonstrated in the design and construction of large central stations containing up to 600,000 kilowatts of generating capacity. Your inquiry is invited.

BUILDERS FOR INDUSTRY

BECHTEL CORPORATION

SAN FRANCISCO

Los Angeles · New York

Installed over 18 years ago on this bridge, Transite Conduit is still on the job despite the attack of corrosive fumes, weather, and vibration.

Resists the Elements: Transite Ducts are standing up far longer than other materials on this cooling-tower wall despite corrosive conditions. Transite's exceptional corrosion-resistance practically eliminates maintenance and replacement costs through the years.

Outlasts other Materials: When other ducts failed to stand up under the streets of a city in the Far West, Transite Ducts were installed. Their life expectancy is far greater than that of the ducts they have replaced.

That's why TRANSITE® DUCTS stay on the job despite corrosive fumes, soils and weather

If you're looking for a conduit that will stand up for years in tough service . . . use Transite Ducts that not only resist corrosion but are immune to electrolysis, too.

Transite, you see, is made of asbestos and cement . . . two naturally corrosion-resistant materials. It stands up in corrosive cinder fills, salt marshes, and other troublesome soils. It also withstands the attack of smoke, fumes . . . and weather conditions will not shorten its service life. Since it is inorganic and nonmetallic, Transite also is immune to electrolysis or galvanic action.

You will find that Transite Ducts save you money on your cableway system not only by staying on the job longer . . . but by holding down the initial cost, too. For further information write Johns-Manville, Box 60, New York 16, N. Y.

4 OTHER REASONS WHY TRANSITE DUCTS DO A BETTER JOB AT LESS COST:

1. Incombustible. Transite will not burn or contribute to formation of smoke, gases, or fumes. It confines burnouts and protects adjacent cables.

2. Permanently Smooth Bore. Transite makes long cable pulls easy. Danger of damage to cables is also minimized.

3. Easy To Install. Transite Ducts are light weight, easy to handle. Joints are quickly made. And, long 10-foot lengths reduce the number of joints in the line.

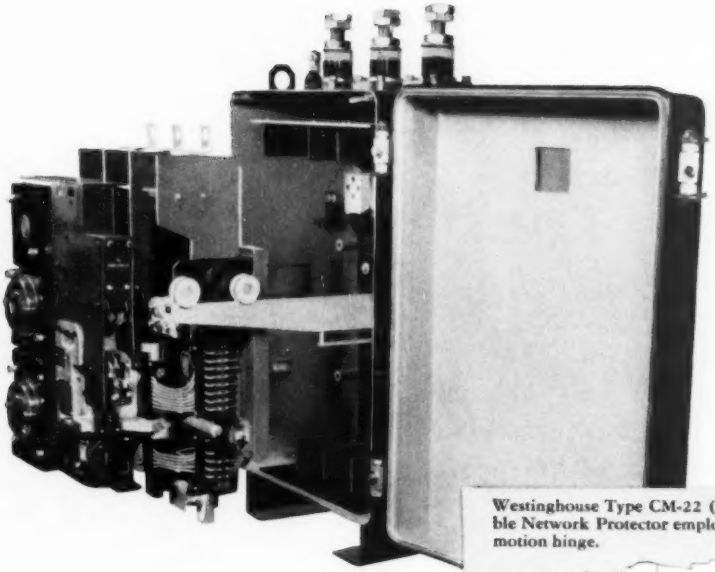
4. Higher Thermal Conductivity. Cables run cooler in Transite Ducts, reducing I²R losses, increasing current capacity, and prolonging insulation life.

Johns-Manville TRANSITE DUCTS

JM PRODUCTS

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement



Westinghouse Type CM-22 (above) submersible Network Protector employs the new dual-motion hinge.

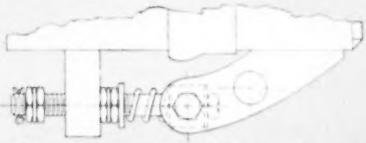
NEW, dual-motion hinge

SIMPLIFIES CLOSING OF NETWORK HOUSING

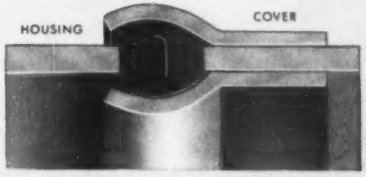
Now, the exclusive Westinghouse quick-opening, submersible Network Protector housing—which eliminated 26 to 44 bolts—has been further improved to simplify the operator's job. A new dual-motion hinge permits the cover to ride forward before it is swung open. This action relieves gasket pressure... leaves no restraining force to work against when closing the cover.

Your operators will like the simplicity and convenience of this Westinghouse "plus," as well as other housing features such as captive hardware, factory-adjusted stop nuts, and provision for hinging on either side. You'll like many additional, exclusive features built into all Network Protectors. For complete information, contact your Westinghouse Representative or write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

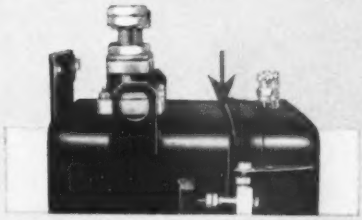
J-60790



Dual-motion hinge detail. Factory adjustment for centering cover is independent of adjustment for gasket deflection.



Tubular Neoprene gasket compressed between machined edges on housing and cover provides a tight seal.



Top of network housing showing uniform gap between housing and gasket before tightening cover. This prevents the hinge side of the cover from "rolling" the gasket.

YOU CAN BE SURE... IF IT'S

Westinghouse

NETWORK PROTECTORS

NETWORK SYSTEMS PAY... IN *Oklahoma City*

OKLAHOMA CITY'S DOWNTOWN GROWTH . . . In 1926, the load on the network area of .083 square mile was about 4,000 kva. Since then, the business area has expanded to .19 square mile, and load has increased to 30,000 kva. This is 7½ times the original load and 2⅓ times the area.

Underground network proves long-term system solution!

Twenty-five years ago, the Oklahoma Gas and Electric Company took an important step for Oklahoma City. They embarked on a long-range system plan enabling them to comfortably and profitably meet a load that has grown 7½ times in an area that has more than doubled. So well did they plan, that even greater expansion can be accommodated without uprooting their basic system.

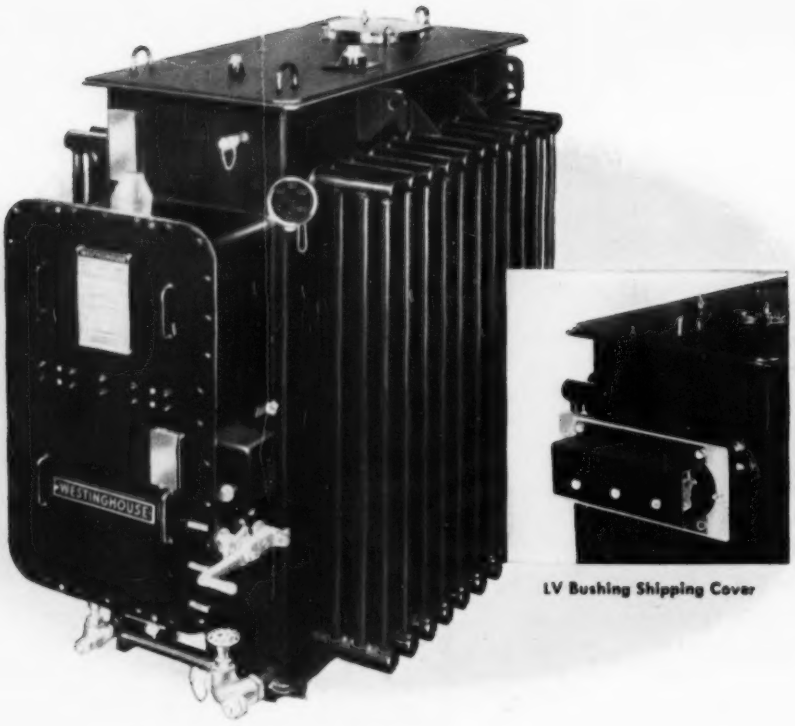
WHAT THEY HAD . . . In 1926, Oklahoma City's downtown area was served from an overhead 2400-volt, delta primary system with single-phase, 3-wire lighting and 3-phase, 3-wire power. In some cases, the load was such that an entire circuit served only one block. Naturally, conditions like this created problems. Pole space was needed for transformers . . . feeder capacity was inadequate . . . substation space and feeder routes were required. Overlooking appearance, an overhead system might have solved existing problems; but the Oklahoma Gas and Electric Company wisely anticipated future expansion and load growth.

WHAT THEY DID . . . Long-range system planning based on practical and economical objectives indicated the installation of an underground, low-voltage A-C Secondary Network System. The initial system was supplied from three 13.8-kv primary feeders through 10,800 kva of network transformers and associated network protectors, to a 3-phase, 4-wire, 120/208-volt secondary network, with primaries bus-regulated.

WHAT THEY NOW HAVE . . . That basic system installed 25 years ago has proved the most economical method of meeting increased load and area growth at every stage of Oklahoma City's expansion. At present, the system has five primary circuits, individual feeder regulation and 40,000 kva of installed network transformer capacity. What's more, there have been few voltage complaints . . . no outages, thanks to network operation . . . and maintenance expense has been almost negligible. System planning has enabled this utility to take full advantage of the latest improvements in the design and reliability of modern unitized electrical apparatus.

Decide now on objectives for your future system, or for making replacements to your present system. Our engineers are ready to help you in your network system planning. Call your nearby Westinghouse Office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-97157

YOU CAN BE SURE...IF IT'S
Westinghouse
NETWORK EQUIPMENT



LV Bushing Shipping Cover

QUALITY in the transformer ADDS RELIABILITY to the network

Everyone agrees that when you install a network system, you install *the best* for reliability and service continuity.

But the degree of reliability...or, more exactly, the freedom from maintenance, depends directly on quality in the transformers.

That's why Westinghouse Network Transformers have continuously wound coils of sliverless copper, to guard against hot spots, crystallization and pricked or scored insulation. That's why they're high-frequency tested, too.

In addition, Westinghouse Transformers are filled under vacuum, and have welded-on covers to assure a perfect seal. Finishes are not only baked for longer life, but bases are undercoated.

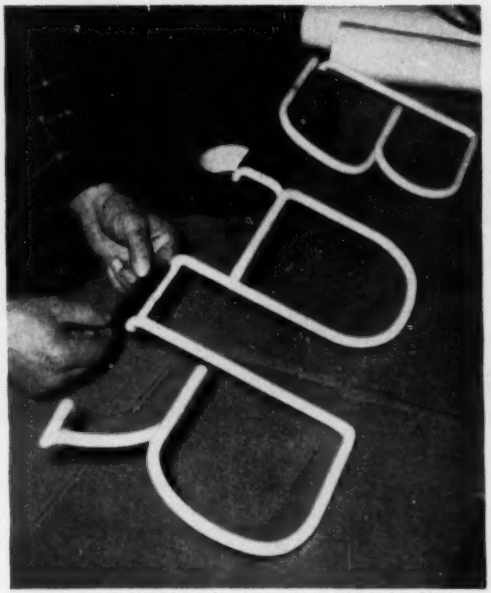
There are many other features such as the LV bushing shipping cover, shown above, that assure safe delivery of the quality built into Westinghouse Network Transformers. Your Westinghouse representative will be glad to give you full information, or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70646

YOU CAN BE SURE...IF IT'S

Westinghouse

NETWORK TRANSFORMERS

WEATHERPROOF TAPE
replaces outdoor paint



Permanent blackout! Polyken Tape No. 214 is used to black out sections of neon tubing quickly and permanently.

Long-life splices. Electrodes that will carry more than 6,000 volts are spliced with Polyken No. 822, which has a 10,000 volt dielectric strength.

This inside job of bundling wires is made-to-order for low-cost Polyken Tape No. 163.

Neon sign maker solves costly maintenance problem on outdoor installations

Appleton Neon Sign Co., Wisconsin, used to black out non-illuminated sections of neon tubes with paint. But the paint would weather off, and the blacked-out sections began to light up, creating a troublesome and expensive maintenance problem.

The answer was simple and effective: use black weather-resistant Polyken Tape No. 214 instead of paint.

Then for splicing high-voltage electrodes, the sign company switched from a vinyl plastic tape to Polyken's exclusive Polyethylene Tape No. 822. The change not only cut costs but also resulted in higher dielectric strength (over 10,000 volts) and greater insulation resistance (over 1,000,000 megohms) at the same time.

Finally costs were cut still further by a switch to Polyken Electrical Tape No. 163 for taping interior electric connections and holding wires for bundling.

These tapes are just three of a complete line of Polyken pressure-sensitive tapes made to save you time and money. Send for free samples and booklet today.

TAILORED TO YOUR JOB

Polyken®

INDUSTRIAL TAPES

Department of Bauer & Black
Division of The Kendall Company

Polyken, Dept. EWM
222 West Adams St., Chicago 6, Illinois

For specifications, samples, and further information on Nos. 163, 214, 822 and other Polyken Tapes, please send me your FREE BOOKLET, "Tape is a Tool."

Name_____ Title_____

Company_____

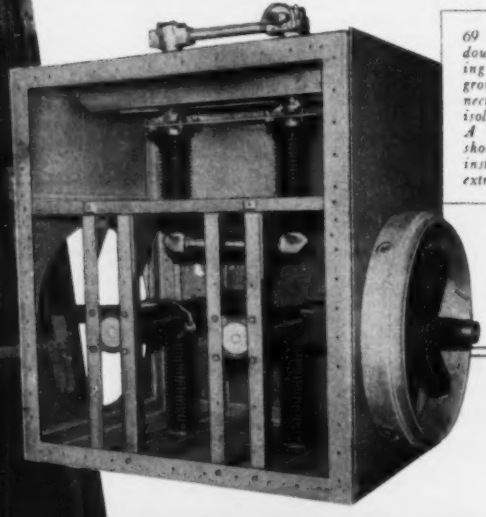
Street Address_____

City_____ Zone____ State_____

Con Edison

(Above) - Bus Section No. 7 completed. Bus Section No. 8 was installed soon after this picture was made, and the buses connect at the capped end shown. Large concentration of generating and tie-feeder capacity is a principal consideration in the selection of isolated-phase construction of the buses with their many safety features.

(Left) - Looking down on bus Section No. 5 and 6 near completion. The selection of 69 Kv was made as the most economical for the East River Station, 60 cycle system. The compactness and flexibility of arrangement, as illustrated here, plus the high safety factor already established in lower voltage ratings, decided the selection of R&IE isolated-phase, metal-enclosed bus and switch structures.



69 Kv., 1500 ampere, double break disconnecting switch complete with grounding switches, connects in-line with the isolated phase bus run. A number of these are shown near the center of installation photograph, extreme left.

Isolated phase generator leads are rated at 15 Kv., 4000 amperes, and the outdoor buses and switching connections are rated at 69 Kv., 1500 amperes.

R&IE

East River...

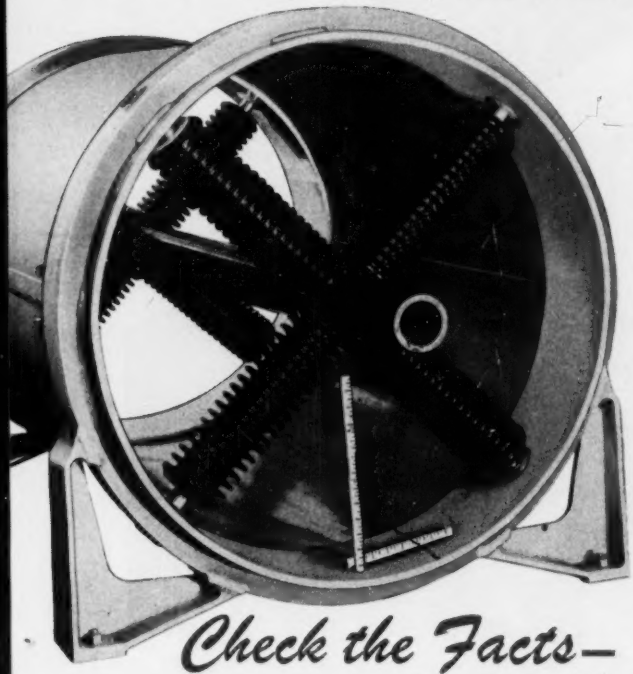
carries Protected Kilowatts on

R&IE

METAL ENCLOSED, ISOLATED PHASE

BUS STRUCTURES

complete from generators, through transformers, to distribution



Bus Structures at East River Station, Consolidated Edison Co. of New York, Inc., includes all supporting steel, grading walkways, stairs, disconnecting switches and pot head cubicles.

Check the Facts—

1. **PHASES** individually isolated and enclosed eliminating costly building and cell construction. Sealed dust-proof with bolted seams. Any section of cover can be opened for inspection.
2. **SUPPORT RINGS** equalize all stresses. Channel shaped for high strength. May be mounted any position.
3. **INSULATION** - Porcelain, always in compression-conductor shock-proof, longitudinally and radially.
4. **INSULATOR ADJUSTMENT** - threaded stud with locking nut and washer.

Typical single phase cable pothead cubicle used in Bus Sections shown at the left.

R&IE EQUIPMENT DIVISION

I-T-E Circuit Breaker Co.

GREENSBURG, PENNA.

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

SWITCH OPERATING MECHANISMS

SUBSTATIONS

RK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

Motorola 2-Way Radio

. . . *First Choice* OF THE POWER AND LIGHT COMPANIES

From coast to coast, Motorola radio is the first choice of the great majority of power and light companies. Here's why:

Motorola radio increases operating efficiency. Radio contact with vehicles saves outage time and eliminates many return trips. Gasoline and repair costs go down, depreciation losses are reduced and valuable man-hours are saved for productive effort. And . . . best of all . . . customer service is greatly improved. At every step of the way Motorola boosts efficiency, increases profits.

Motorola equipment is designed for top performance and long life. Superior components and research-tested circuits mean low operating costs, reduced maintenance and obsolescence-proof equipment. Your investment is *protected* for years to come.

Motorola radio equipment has a wide edge on competition. Motorola supplies the right equipment for *your* requirements . . . anything from Handie-Talkie® radiophones, mobile units and fixed stations to thousand-mile microwave networks! Your system is *engineered* for your job.

Write today for information and engineering assistance in planning your system.

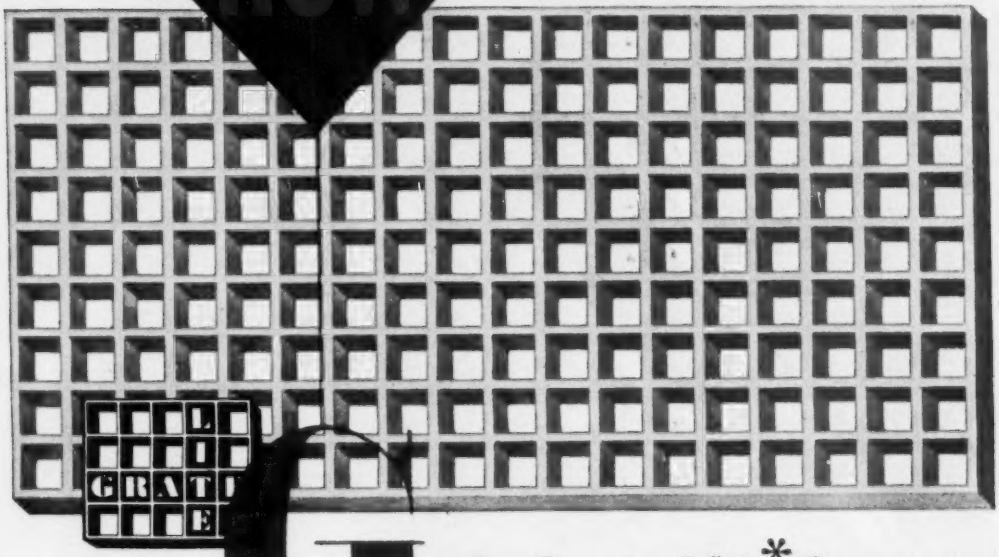
Central dispatcher at remote control console. Two-way radio at his finger tips helps get repair crews directly to trouble spots.

Line crew foreman using mobile radio. Instant contact with dispatcher saves travel time, gets needed supplies, summons help in emergencies.

Motorola®
Communications & Electronics Division
4545 Augusta Blvd., Chicago 51, Illinois
Rogers Majestic Electronic Ltd., Toronto, Canada

new

OPEN LIKE A LATTICE
DIFFUSING LIKE GLASS



Guth GrateLite* Louvre

the latest idea in lighting

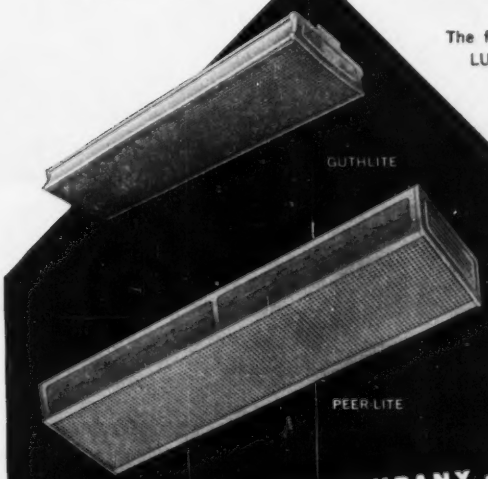
A SYMPHONY OF DIFFUSED LIGHT

*U.S. & Can. Pats. Pend.

The first integral plastic louvre for fluorescent lighting, molded of LUSTREX polystyrene. It reveals a new conception of architectural beauty and efficient lighting: Its diffusion results from the ¾" cubical lattice that cuts off direct light at a 45° angle.

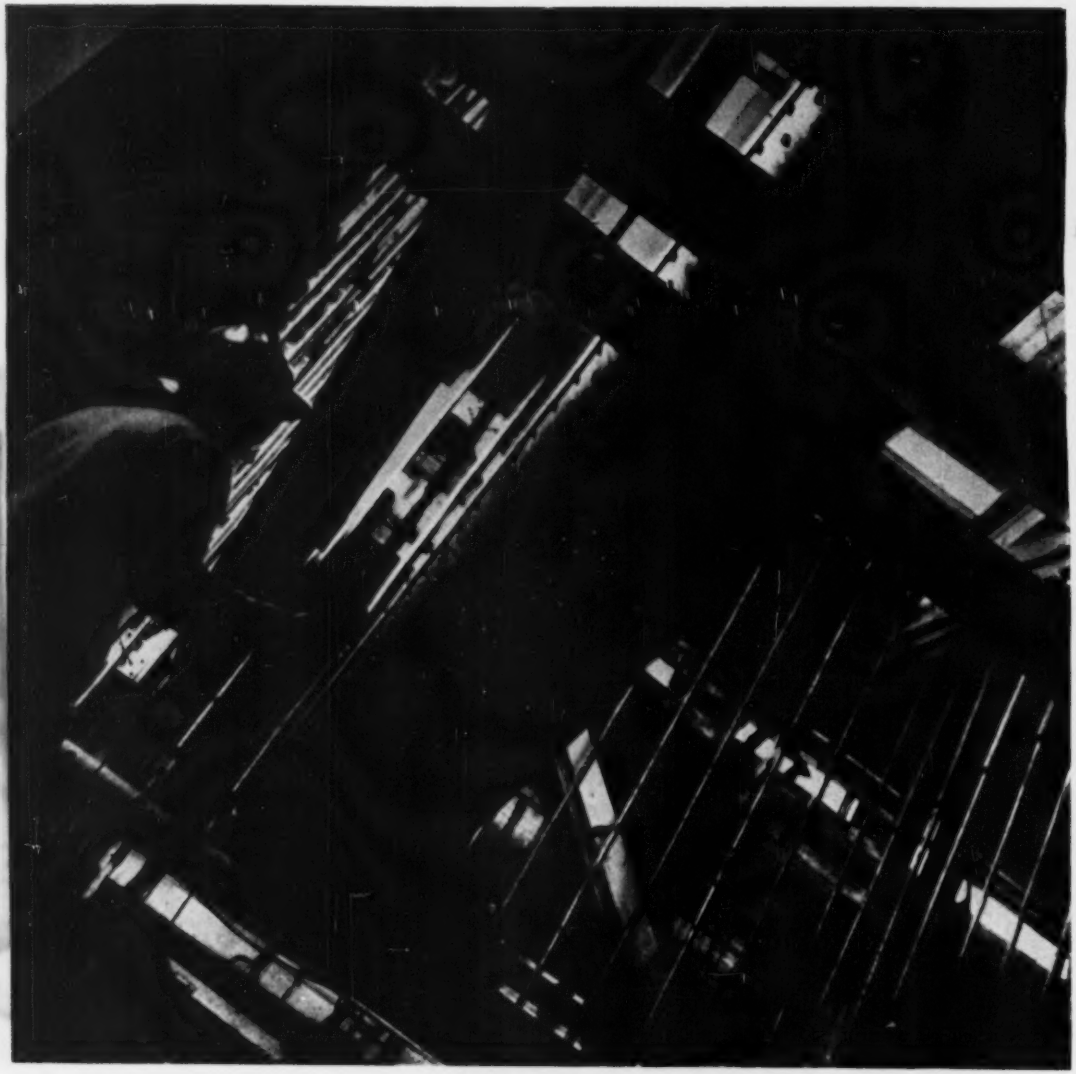
But words alone cannot describe beauty. See for yourself and ask to be shown a sample. It will give you a new outlook on lighting.

GrateLite is tough, quickly cleaned and de-staticized. It is furnished in one piece with Guth Fluorescent Fixtures.



GUTH'S GOLDEN YEAR
19 Guth 52
...leaders in lighting since 1902

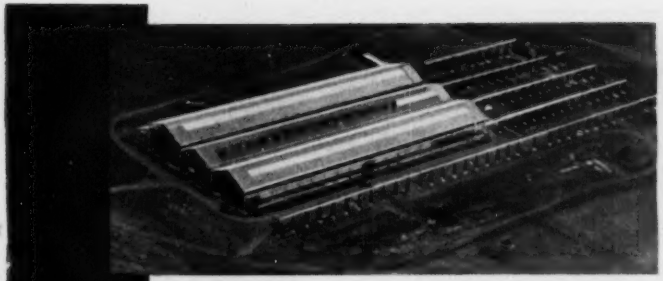
THE EDWIN F. GUTH COMPANY · ST. LOUIS 3, MO.



SPEEDING STEAM POWER

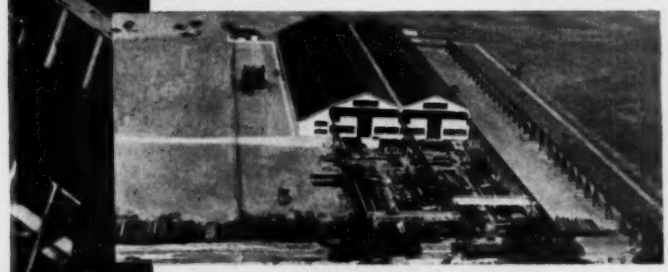
BABCOCK & WILCOX

G-582T

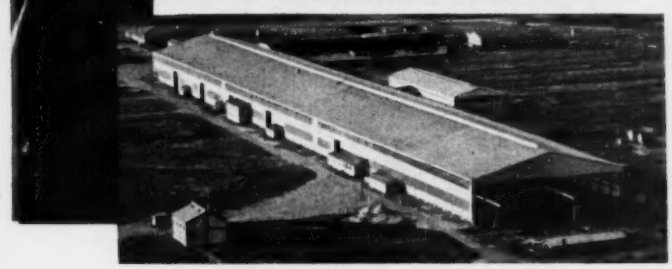


Paris, Texas

Wilmington, North Carolina



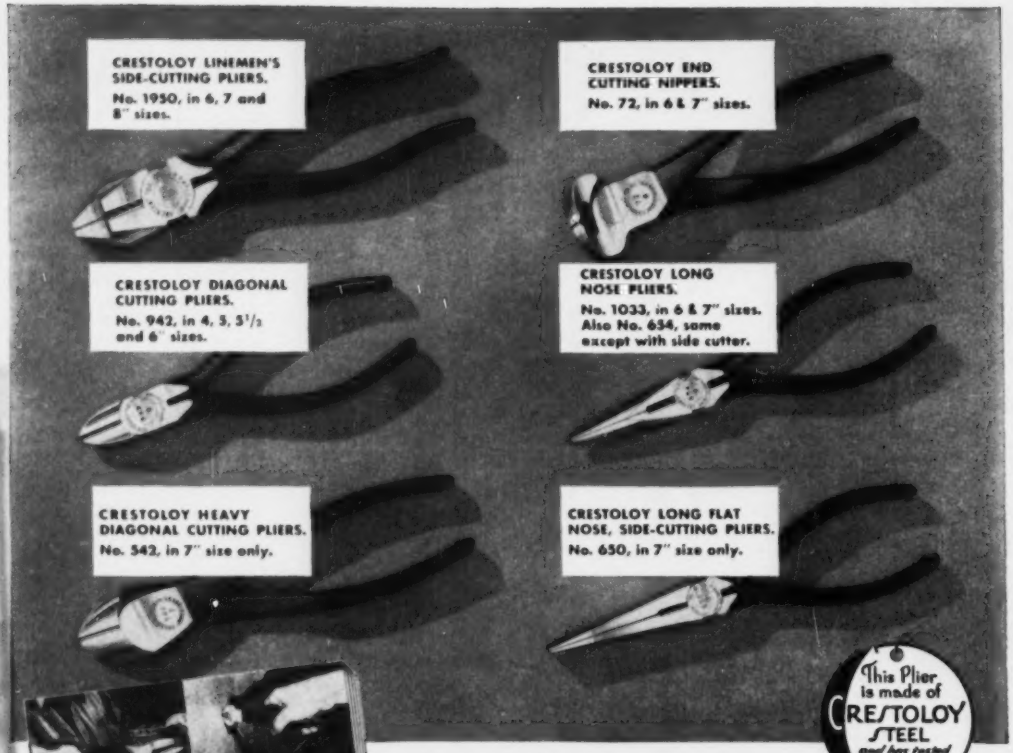
West Point, Mississippi



Brunswick, Georgia

ON FOUR NEW FRONTS

America's industrial growth is measured in kilowatts, units of electrical energy which make up the brawn and sinew of U. S. production. More and more of these energy units are being consumed in this land which is, characteristically, always building, always pioneering. In fact, so many lusty, bawling industrial infants—children of America's men of vision—are growing up so fast that Babcock & Wilcox is pouring millions of dollars into new plants and equipment to provide more steam power for public utilities and for all industry. New plants at Wilmington, N. C., West Point, Miss., Brunswick, Ga., and Paris, Texas, recently have been added to B&W's network of facilities for manufacturing the equipment to harness energy through the driving force of steam. In all, ten great B&W plants, spotted around the map like sentinels helping to guard the nation's strength, are efficiently geared to continue to contribute to America's boundless potential.


CRESTOLOY LINEMEN'S SIDE-CUTTING PLIERS.
No. 1950, in 6, 7 and 8" sizes.
CRESTOLOY END CUTTING NIPPERS.
No. 72, in 6 & 7" sizes.
CRESTOLOY DIAGONAL CUTTING PLIERS.
No. 942, in 4, 5, 5 1/2 and 6" sizes.
CRESTOLOY LONG NOSE PLIERS.
No. 1033, in 6 & 7" sizes. Also No. 634, same except with side cutter.
CRESTOLOY HEAVY DIAGONAL CUTTING PLIERS.
No. 542, in 7" size only.
CRESTOLOY LONG FLAT NOSE, SIDE-CUTTING PLIERS.
No. 650, in 7" size only.

This Plier is made of CRESTOLOY STEEL and has tested 100% satisfactorily

CRESTOLOY PLIERS

are individually tested!

Crestoloy Pliers take all the guesswork out of plier buying, because Crescent has taken all the guesswork out of plier making. Rigid specifications establish the material, design, workmanship, tests and inspection of these better tools. Strict adherence to these specifications is maintained by continuous tests and relentless inspection of the *individual* tools. Every plier carries the Crestoloy tag certifying that it has been individually tested.

GET YOUR FREE COPY . . .

This new 20-page booklet provides many useful how-to-do-it ideas both for amateurs and professional mechanics, as well as basic information on the proper selection, use and care of hand tools. 93 illustrations. Write today.

CRESCENT TOOLS
Give Wings to Work

Sign of the Artisan
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Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

Reduced Maintenance
Improved Reliability

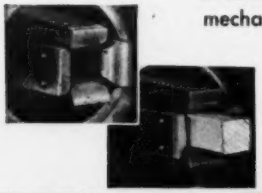
PACIFIC ELECTRIC
Type RHE
CIRCUIT BREAKERS

115, 138, 161 kv — 3 or 5 cycles
196/230 and 230 kv — 3 cycles
to 10,000,000 int. kva (ASA)
at 161 and 230 kv
(Also other types, 7.5 kv and up)

Electrically and Mechanically Trip Free
ASA, AIEE, and NEMA STANDARD

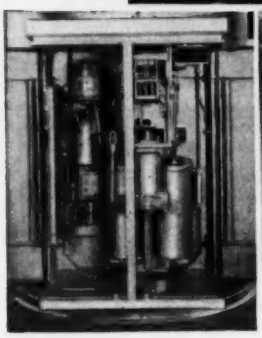
Applicable Standards of ASA, AIEE, and NEMA assure electrical performance of any breaker that meets such requirements . . . but *mechanical* construction, upon which maintenance cost and reliability largely depend, still remains subject to the manufacturer's design approach.

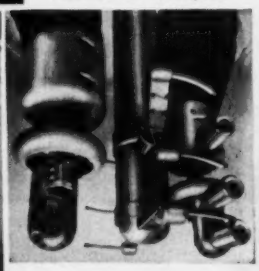
Pacific Electric solicits critical examination of its Type RHE breakers from both the electrical and mechanical standpoints.



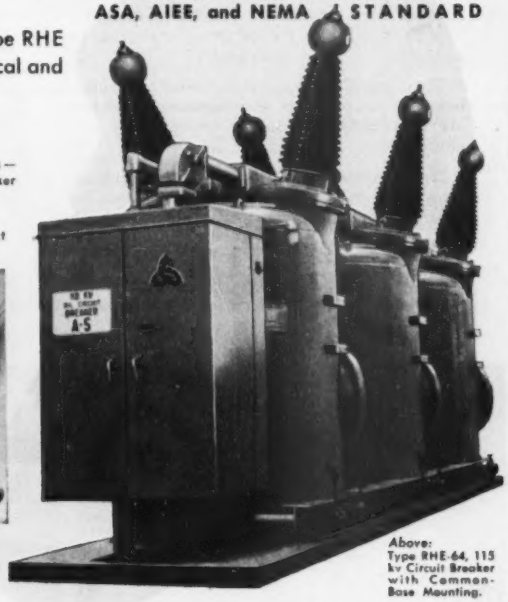
At Left:
Sliding Shoe (finger) Contacts — Six Such Groups in Each Breaker (shown open and closed).

Below:
One-Piece Moving Contact Structure and Interrupters.





At Left:
Operating Mechanism with Oil-Hydraulic System.



Above:
Type RHE-64, 115 kv Circuit Breaker with Common-Base Mounting.

PACIFIC TYPE RHE Breakers embody mechanical features that contribute to low maintenance cost and improved reliability of the breaker and the substation at which it is located. These features assume increasing importance as the upward trend of wages and service salaries continues.

Only One Moving Element in the Tank—Opening accelerating springs and shock absorbers are outside of the tank. As no parts in the tank require service adjustment, maintenance within the tank is largely eliminated. Entrance bushings are under negligible mechanical stress.

Nested Sliding Shoe (finger) Contacts—Self-cleaning; arc foot-points confined to portions of surfaces that do not carry load current; minimizes contact dressing.

Oil-Hydraulic Restoration of Closing Energy—Simple; reliable; lack of tightness of valves does not prevent normal operation—it only slightly increases time for restoration of full energy.

Anti-Friction Bearings—Sealed and lubricated at time of assembly, require no further attention. Lubrication points practically eliminated.

Easy Manual Operation for Load Switching—If control power is lost, the breaker may be closed manually. Then two minute's hand operation of the oil pump prepares the mechanism for O-C-O after fault, or for manual closing after manual opening—all at rated speeds.

These and other advanced features are described in Catalog 585.

PACIFIC ELECTRIC MFG. CORPORATION

5815 THIRD STREET, SAN FRANCISCO 24, CALIFORNIA • 4500 HARRISON STREET, GARY 10, INDIANA

Since 1906

SALES OFFICES or AGENCIES in PRINCIPAL CITIES

Right on the job!

International Trucks are strictly *right* on the job because they incorporate all the advantages a service truck should have. They're rugged, dependable, economical to operate.

The all-steel service-utility bodies are welded into one rugged unit. Compartments and bins are of various sizes to accommodate all your equipment.

There are many International Trucks to choose from. Your International Dealer or Branch can help you find the one that's right for your job.

INTERNATIONAL HARVESTER COMPANY · CHICAGO

Only International gives you all this:

- Silver Diamond valve-in-head truck engines are rugged, packed with extra power. Engineered to save you plenty on operating and maintenance costs.
- New green-tinted, non-glare safety glass available in the Comfo-Vision Cab. One-piece full-vision windshield.
- Super-steering—more positive control. Wider front axles make possible full 37° turning angle for easier handling and maneuverability.
- Wide variety of light-duty models — ½, ¾, and 1-ton sizes — GVW's from 4,200 to 8,600 lbs. 115, 127, 134-in. wheelbases. Pickup, panel, stake, and many other types of bodies.

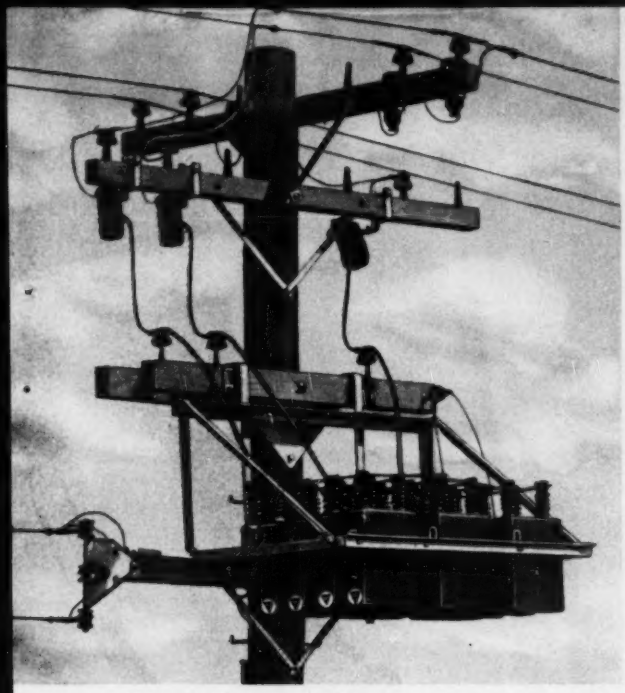
International Harvester Builds McCormick Farm Equipment and Farmall Tractors . . . Motor Trucks . . . Industrial Power . . . Refrigerators and Freezers

Better roads mean a better America

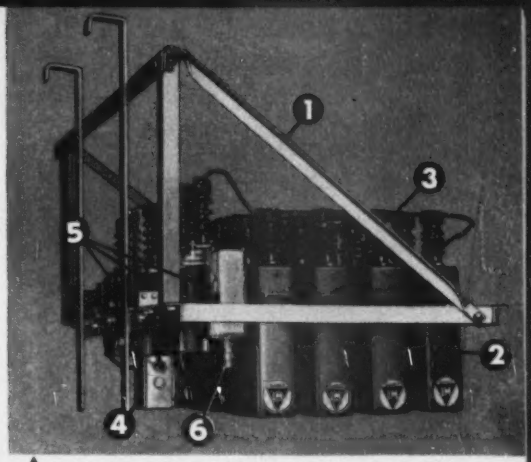
INTERNATIONAL TRUCKS

Standard of the Highway

International L-130 series with special service-utility bodies—115 and 134-inch wheelbases. GVW's from 6,800 to 8,600 lbs.



A 300 kvar switched capacitor rack serving a suburban area. Note the simple, compact arrangement and accessibility of the entire assembly. Wiring is completely bird-proof.



▲ Details of the L-M racks. (1) Rugged angle steel rack. (2) Elemex Capacitors. (3) Neoprene-covered wiring with Neoprene terminal caps. (4) Weatherproof terminal box for low voltage control wiring is easily accessible. (5) L-M Type NR oil switches. (6) Weatherproof plug-in connection to switch.

New and Exclusive Oil Switch Plug-In Connection Simplifies Maintenance

A weatherproof plug-in connection and weatherproof plug at the base of the oil switch control housing permits the switch to be disconnected without disturbing any of the low voltage wiring. Only one easy-to-reach connection to break and the switch is ready to be removed for service. It's so simple that the three switches can be disconnected in less than a minute.

L-M's Open Rack Capacitor Assemblies Are Completely Wired To Save Linemen's Time

by **HAROLD T. ZAMZOW**, Manager, Capacitor Sales, Line Material Company

With completely assembled capacitor racks, wired at the factory, the cost of installation of either switched or unswitched banks is greatly reduced. This becomes a major factor when one considers both installation costs and the availability of capable linemen.

Bird-Proof Wiring

L-M's racks are mounted in strong angle-steel frames, and provided with lifting lugs. All high voltage connections are made with ¾" Neoprene-covered conductor. Bushings are covered with unbreakable Neoprene terminal caps. This provides an absolutely bird- and squirrel-proof assembly.

Switched or Unswitched Assemblies

Assemblies may be switched or unswitched. Switched racks are provided with L-M's motor-operated "NR" oil switch in each phase. These are electrically interconnected to give three-phase operation. Control connections are made to a weatherproof terminal box mounted in the rack. Only simple, low-voltage wiring is necessary. For control, L-M's Type CCV voltage-sensitive control is suggested. This control can be adjusted in the field without test equipment. Time clocks or pilot control also may be used.

Fully Tested and Guaranteed

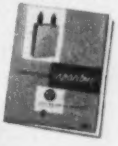
Elemex Capacitors are 100% tested during and after manufacture, and the completely wired assembly, including switches, is thoroughly retested and guaranteed. Thus the operator using these assemblies is assured of dependable operation, with an appreciable saving in overall costs.

Available in Various Assemblies

L-M's completely wired capacitor assemblies are available in 5 kv and 15 kv racks up to 300 kvar switched or 375 kvar unswitched. Total cost of switched banks is as low as $5.66 per kvar, and unswitched banks as low as $4.52 per kvar, completely wired!

Get Full Information

For full information on ELEMEX Capacitors and L-M's completely wired assemblies, ask the L-M Field Engineer; or write Mr. Zamzow at Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



LINE MATERIAL 104

Elemex Capacitors

Complete Coordinated Equipment for Distribution Today

L-M's NEW PID
5 KV 100 ampere
intermediate duty cutout.
Reflective markings easily seen from the ground identify the door and cutout. Doors are easily removed and replaced with a switch stick, for safety.
Cutout rating and date of manufacture sandblasted into side of box for permanent identification.
5000 V
100 A.
LM-52

L-M's New PID Cutout Provides Up To 166% Higher Interrupting Capacity At 20% Lower Cost

Costs 20% less than standard 100 ampere cutout; interrupting capacity 166% higher at 2.5 kv (8000 amperes), 66% higher at 5 kv (5000 amperes). Box will accept all standard 50 ampere doors, thus permitting one box to be used for both 50 and 100 ampere service. Also takes 200 ampere switch blade door.

L-M's PID Cutout is designed to provide a 100 ampere intermediate duty cutout at an appreciable saving over standard 100 ampere cutouts. Boxes are smaller and more compact than standard 100 ampere cutouts—they are the same size as a 50 ampere cutout but terminals and contacts are heavier. Thus the cutout will take any of L-M's 50 ampere doors, as well as the 100 ampere intermediate duty and 200 ampere switch blade door.

The non-disconnecting door provides positive link ejection and circuit interruption even on low current faults.

Both cutout and switch blade doors can be removed and replaced with standard switch sticks, providing additional safety.

Cutout and disconnect switch doors are easily identified from the ground by the reflecting markings on the doors. Rating and date of manufacture are sandblasted into sides of box for permanent identification.

Get Details on L-M Fuse Cutouts

L-M offers complete families of open and closed type cutouts to meet a wide range of requirements. Interchangeable doors offer low first cost and economical capacity increases as loads are increased. For complete information ask the L-M Field Engineer or write for bulletins. Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LM

LINE MATERIAL

fuse cutouts

103

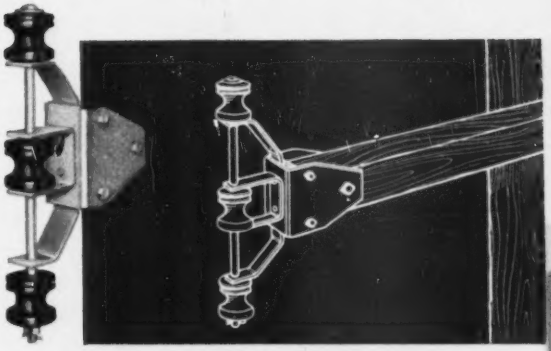
Complete Coordinated Equipment for Distribution Today

LINE CONSTRUCTION BLUEPRINTS

HOW SOME UTILITIES ARE MAKING CONSTRUCTION WORK EASIER . . .
IN WAYS THAT MAY BE HELPFUL AND USEFUL TO YOU.

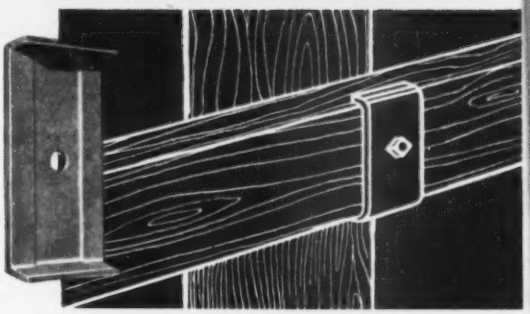
CROSSARM END RACK

Designed to take 3-wire service leads directly from the end of the secondary crossarm. Tends to conserve pole space and clean up overcrowded poles—without impairing climbing space. Heavy galvanized steel. ⅝″ buttonhead thru-rod. Cat. No. 330073B1.



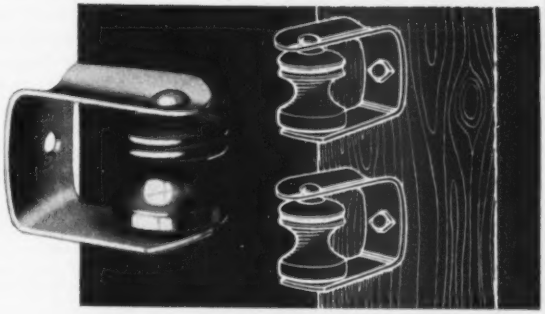
CROSSARM REINFORCING PLATE

For use over crossarms with crossarm mounting bolts to make doubly sure that the arms won't split or check. Heavy 3/16″ steel, 3⅛″ wide by 8″ long, thoroughly galvanized, with ¾″ offset angle end and 13/16″ diameter hole. Cat. No. 323489X1.



SINGLE SPOOL SECONDARY RACK

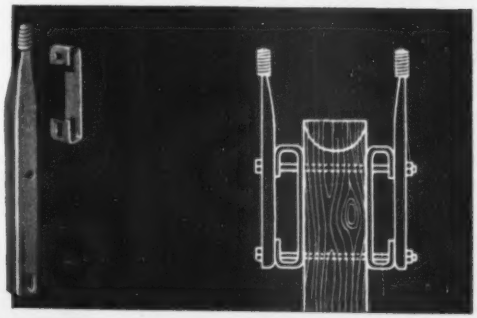
Heavy gauge steel strap base 3″ wide, with 4″ length from pole to ⅝″ steel insulator pin. Base is curved to fit the pole, insuring a good, rigid installation. Available with or without wet or dry process spool insulators. Cat. No. BA25X7 (without insulator).



POLE TOP PIN and MOUNTING BRACKET

A strong pole top pin and a companion extension bracket that can be mounted singly or in pairs. The pin is No. 8 gauge steel. Transverse loading, 1500 pounds, longitudinal loading, 1200 pounds. Cat. No. 317011B1.

Bracket is ¼″ steel; gives 2″ extension from pole. Bolt holes and slots accurately match the pin. Cat. No. 211048A1.



Do you have a line construction problem?

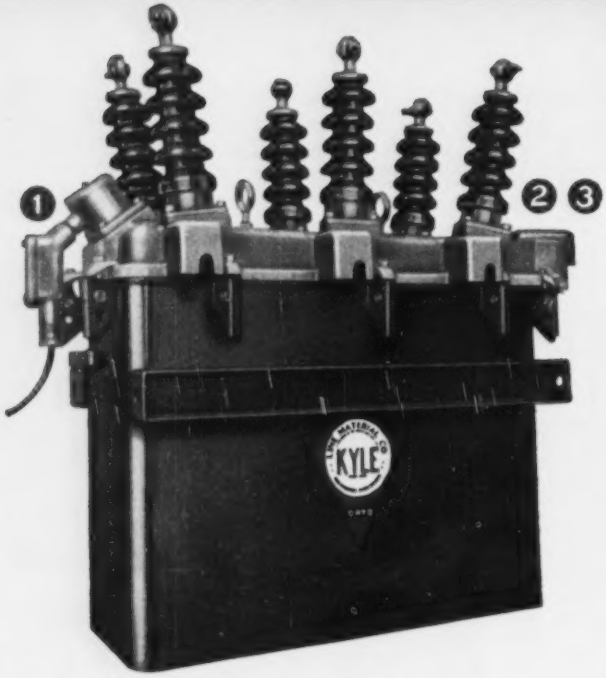
These are just a few of thousands of L-M line construction specialties. If you have a problem, let us know. We may have standard or special items in stock that will solve it. Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL

Line Construction Materials

Complete Coordinated Equipment for Distribution Today

107



L-M's Kyle Type 3H Recloser Provides Automatic 3-Phase Protection

With three units in one tank, linkage tolerances can be controlled more closely, insuring more accurate and dependable 3-phase operation of the recloser.

The Kyle Type 3H 3-phase recloser provides individual reclosing and resetting on each phase for temporary faults. In case of permanent fault on any one phase, the recloser locks out *all three phases simultaneously.*

The Kyle 3H Recloser can be coordinated with sectionalizers or branch line fuses to isolate permanent faults to small sections of the system. Because all three units are in one tank, there is no external linkage; and greater operating accuracy and dependability are assured.

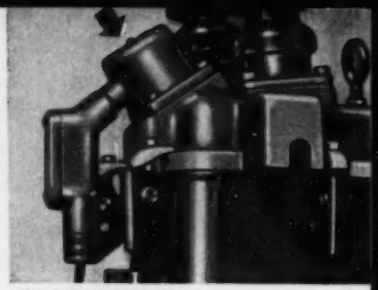
Positive toggle action; fast opening and closing do not depend on gravity. The Kyle hydraulic mechanism has proved itself over years of service to be dependable and trouble free.

The Kyle 3H can be applied on systems up to 15 kv, with nominal load ratings from 5 to 50 amperes and minimum trip currents from 10 to 100 amperes. Coils are easily changed right in the field. Interrupting ratings from 150 to 1200 amperes. Trip-free operating handle and all other Kyle safety features. Plated Universal bushing terminals for copper or aluminum. Available with the accessories shown at the right.

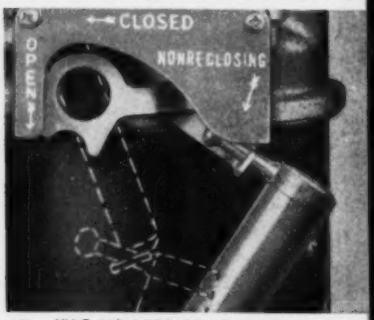
Get the Whole Story of Automatic Protection

Ask the L-M Field Engineer for a copy of Bulletin CR-1, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

Like all Kyle reclosers, the Type 3H is filled with ORTO®, L-M's oxidation-resistant transformer oil.

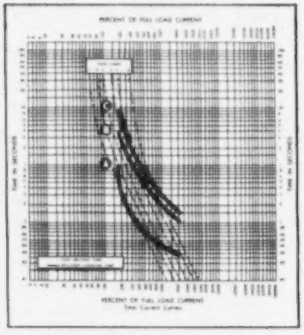


1 SHUNT TRIP COIL: an optional accessory that permits tripping the recloser from a distant point so it will not reclose. Or for ground fault-tripping with relay or other control equipment, the coil locks out the recloser in one fast operation. Must be built in at the factory.



2 KYLE NON-RECLOSING FEATURE: when control lever is down, this accessory prevents automatic reclosing, providing fast lockout on the first operation, for greater safety for men and equipment during hot line work. Available on all Kyle reclosers.

3 AUXILIARY SWITCH: an SPDT switch that may be attached to a Kyle 3H recloser. It may be used either to operate a remote indicator light to show when the recloser is open and closed; or as a limit switch to cut off current from the shunt trip coil after it has operated.



Kyle Reclosers offer the widest choice of time-current curves and sequences. You can select from Curve A, fast; B, retarded; C, extra-retarded. Choice of seven sequence combinations; sequences quickly changed right in the field.

LINE MATERIAL
Kyle® Reclosers

97

Interrupting ratings now up to 6000 amperes at 4.8 kv, 4000 amperes at 14.4.

Complete range of nominal load ratings from 25 to 200 amperes, for 2.4 to 14.4 kv service, makes available the greatest number of sectionalizing points in this class.

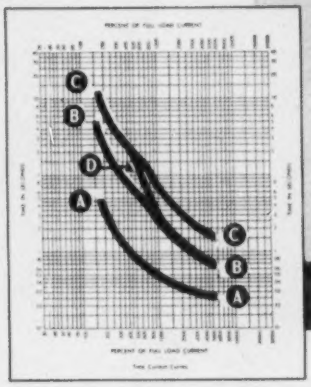
Only Recloser with:

Choice of four time-current curves, ten tripping sequences, which gives maximum flexibility in meeting all coordination problems on heavily loaded distribution circuits.

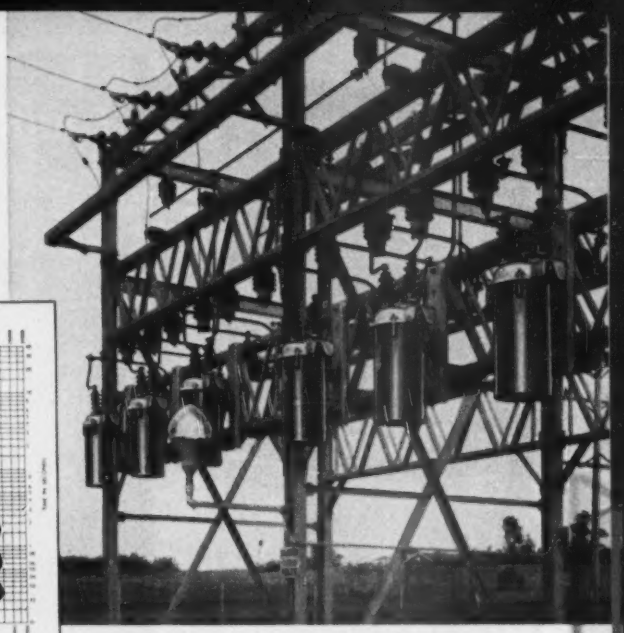
Full power-class design, with 110 kv basic insulation level.

Clamp-on bushings, with plated Universal terminals for copper or aluminum conductor.

Oil Cross Blast arc interruption insures rapid clearing of heavy faults.



Only recloser with choice of 4 time-current curves and 10 operating sequences. Coils and sequences are easily changed in the field.



Kyle Type L Reclosers at a middle-western power company substation, where they help assure uninterrupted service to an urban area.

L-M Increases Interrupting Rating, Adds 200-amp Rating to Kyle Type L Recloser

To protect substations and feeders with heavier loads and higher fault currents, L-M has added a 200-ampere rating to the Kyle Type L Recloser, and has increased interrupting ratings appreciably.

The higher interrupting ratings are based on extensive testing of production reclosers, as well as field experience, and apply to Kyle Type L Reclosers already delivered.

The new higher nominal load rating involves a new coil and some increase in the capacity of certain current carrying parts. The changes can easily be made on any Type L reclosers now in service if desired.

The Kyle Type L not only handles present heavy loads, but it offers increased capacity for the future, plus the present benefits of Type L performance and economy. It provides complete coordination with fuses and other reclosers in series, with a corresponding reduction in fuse blowing and service calls.

Heavy Duty
Type L Single Phase
Nominal Rating 14.4 kv, BIL 110 kv

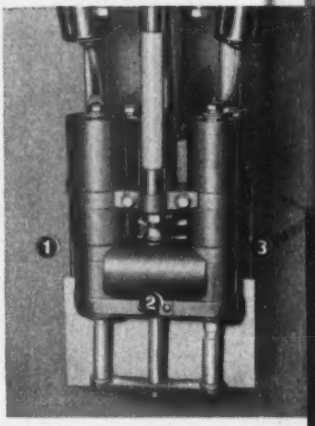
Rating Amperes	Minimum Tripping Current Amperes	Interrupting Ratings* Symmetrical RMS Amperes at Maximum Phase to Phase Nominal Voltage of: 4.8 kv	14.4 kv
25	50	1500	1500
35	70	2100	2100
50	100	3000	3000
70	140	4200	4000
100	200	6000	4000
140	280	6000	4000
200	400	6000	4000

*Recloser interrupting ratings are based on the maximum test circuit X/R ratio of not less than 8, and the asymmetrical rating in total RMS amperes is 1.4 times the symmetrical ratings given in the table.

Get the Details

Ask the L-M Field Engineer for full information on the Type L and other Kyle Reclosers providing complete, coordinated protection; or write for a copy of bulletin CR-1A. Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

Kyle Reclosers are filled with ORTO®, L-M's oxidation-resistant transformer oil.



Rapid oil cross blast arc interruption. Double contacts draw two arcs in series. Gas from one arc at 1 blasts oil in chamber, 2, across arc at 3, extinguishing it.

LINE MATERIAL
Kyle® Reclosers

COMPLETE COORDINATED AUTOMATIC PROTECTION FROM SUBSTATION TO LOAD

99

A GOOD BUY for Outdoor Installations

CEMENT MILL
Installation in Eastern Pennsylvania.

Save Housing Costs— Production Space

COMPLETE Overload and Fault Protection in each Starter

OIL REFINERY
Installation in Northwestern Ohio.

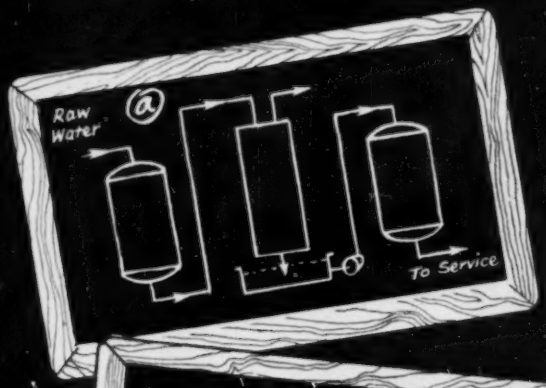
EC&M VALIMITOR Starters for 2300-4600 volt motors are built in corrosion-resistant, drip-proof enclosures to supply their own protection against the weather-elements when mounted out-of-doors. Expensive control rooms are not necessary and installation is speeded by the totally-enclosed, completed-wired construction of these EC&M starters.

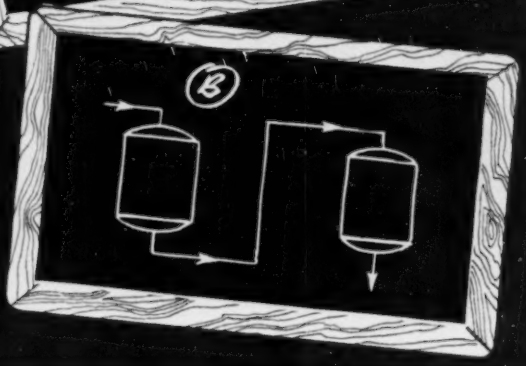
Equally important is the OVERALL protection against overloads and short circuits provided by these EC&M VALIMITOR Starters. EC&M Overload Relays trip instantly on faults and give inverse-time trip on overloads. The high interrupting capacity contactor and VALIMITOR coils clear the circuit quickly and safely. Fuses and spare units for replacement are not required.

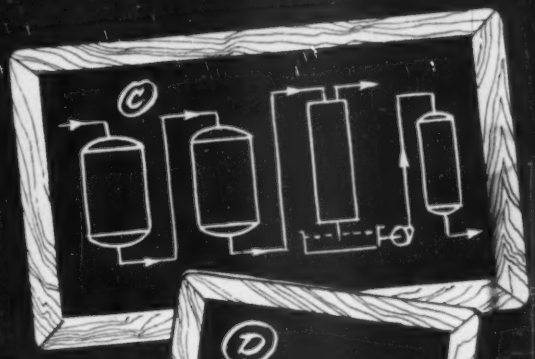
Write for T9-117 Reprint Bulletin

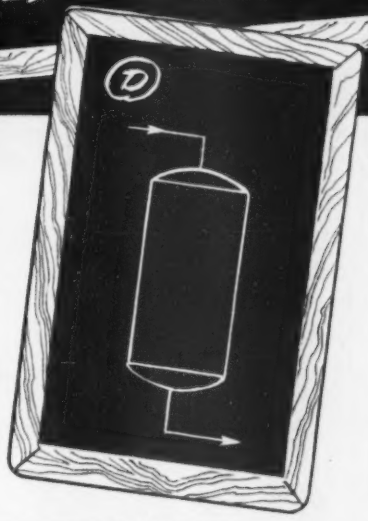
THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET ★ CLEVELAND 4, OHIO

The ABC's of Better Boiler Feedwater









● Permutit ion exchange processes remove dissolved mineral matter including silica. And produce feedwater equivalent to distilled water at only a small fraction of the cost of distillation.

For high pressure power plants that means it is now possible to avoid boiler scale and hard-to-remove silica deposits on turbine blades.

Demineralization is accomplished by the use of two ion exchange resins—Permutit Q and Permutit S. Permutit Q is a high capacity hydrogen cation exchange resin. Permutit S is a highly basic anion exchange resin.

Several arrangements of equipment are used depending on the individual requirements—composition of the raw water, volumes to be treated, boiler pressures and operating conditions. Permutit will cooperate with you in selecting the hookup best suited for your boiler plant. Write today for full information.

A **TWO STEP WITH DEGASIFIER:** In large demineralizing plants, a degasifier is usually included as an inexpensive means for removing carbon dioxide.

B **TWO STEP WITHOUT DEGASIFIER:** No repumping required. Used where total quantities are not very great or with waters of low bicarbonate content.

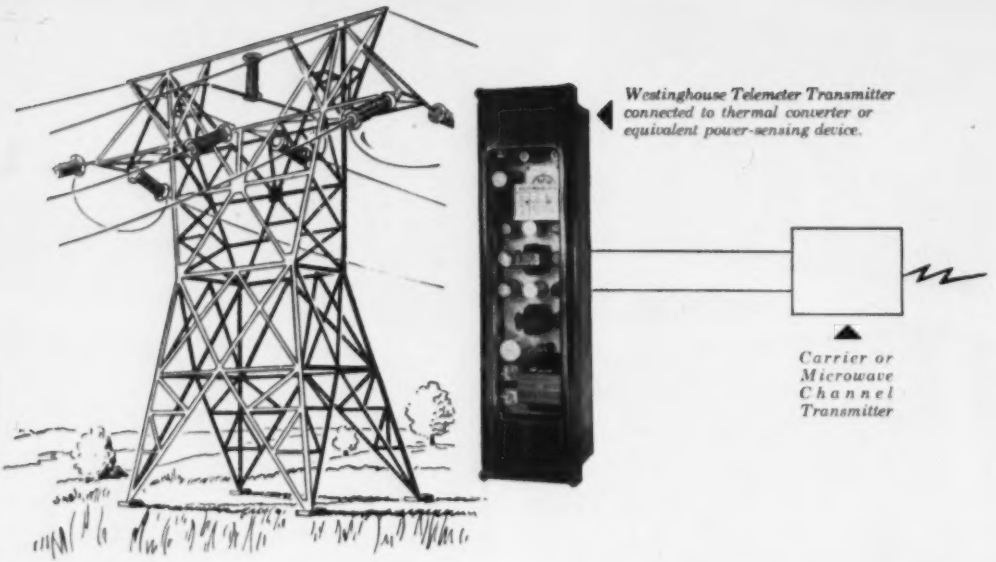
C **THREE STEP WITH DEGASIFIER:** Extremely economical and effective arrangement for waters containing relatively high amounts of sulfates and chlorides.

D **MIXED BED:** An extremely compact arrangement. Both cation and anion exchangers are in the same unit. Used alone or as a final step.

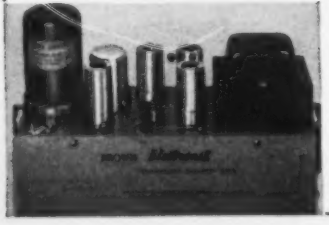
The equipment described is also furnished in multiunit arrangements to treat whatever quantities of water are required and to meet all operating conditions.

PERMUTIT

ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS


Westinghouse Telemeter Transmitter connected to thermal converter or equivalent power-sensing device.
Carrier or Microwave Channel Transmitter

Accurate, instantaneous



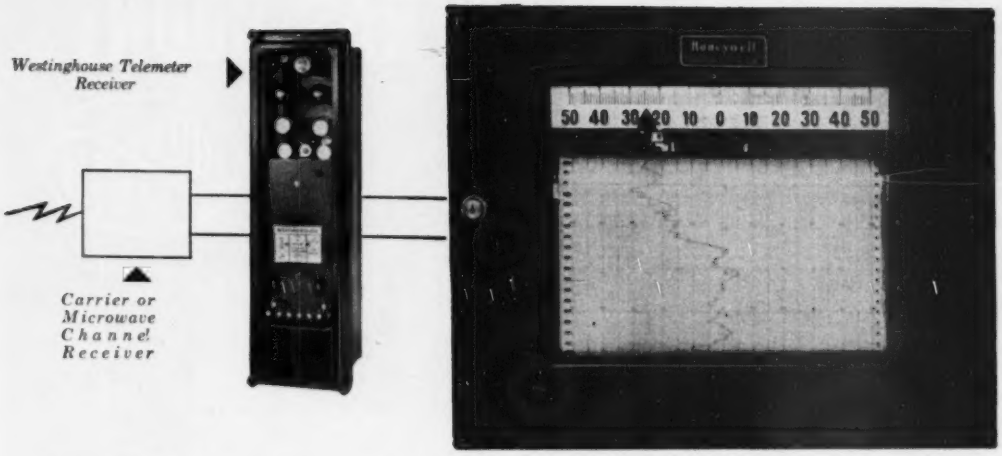
Flexibility... Dependability... for all power plant measurements

The versatile *ElectroniK* recorder is applicable to measurement of pressure, flow, speed, pH, conductivity, power, current, voltage, temperature . . . the *same basic instrument for all*, with changes only in measuring circuit and sensing elements. Use of standard, interchangeable components simplifies maintenance, reduces parts-stocking problems. Single-point and multi-point models are available in a choice of printing speeds, and with chart speeds from ½" to 120" per hour.

The utmost in dependability demanded by power plant applications is insured by *ElectroniK* components . . . life-tested, service-proved, designed for minimum, easy maintenance. These rugged "building blocks"—the high-torque balancing motor, the hermetically sealed converter, the simplified continuous-balance amplifier—typify construction that minimizes the number of moving parts, and that eliminates troubles from dust and atmospheric humidity.

● *Important Reference Data*

Write for Instrumentation Data Sheet No. 9.1-9, "Improved Westinghouse Telemetering System"... and for



Westinghouse **Freq-O-Tron** *continuous telemetering system (variable frequency type) with* **ElectroniK** *strip-chart recorder*

***ElectroniK** Recorder*

facts on system loads

through continuous telemetering with ElectroniK RECORDERS

THE ultra-fast telemetering equipment shown above keeps the load dispatcher in constant touch with all parts of the system. It tells him every change in tie line interchange, in station generation, and in system load—the instant that a change takes place. Operating over carrier current or microwave channels, it spans distances of hundreds of miles . . . eliminates the delays and uncertainties of intermittent, non-continuous measurement.

The *ElectroniK* recorder presents load data in full, readable detail on its big, 11-inch-wide strip chart, where every significant change and trend stands out for the dispatcher's attention. The rapid response of *ElectroniK* continuous-balance measurement assures full utilization of the inherent speed of the telemetering equipment. And the industry-proved dependability of *ElectroniK* construction means absolute minimum maintenance, and uninterrupted performance.

Your local Honeywell engineering representative will be glad to give you full details. Call him today —he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4568 Wayne Ave., Philadelphia 44, Pa. Service available promptly from more than 55 offices in principal cities of the United States.

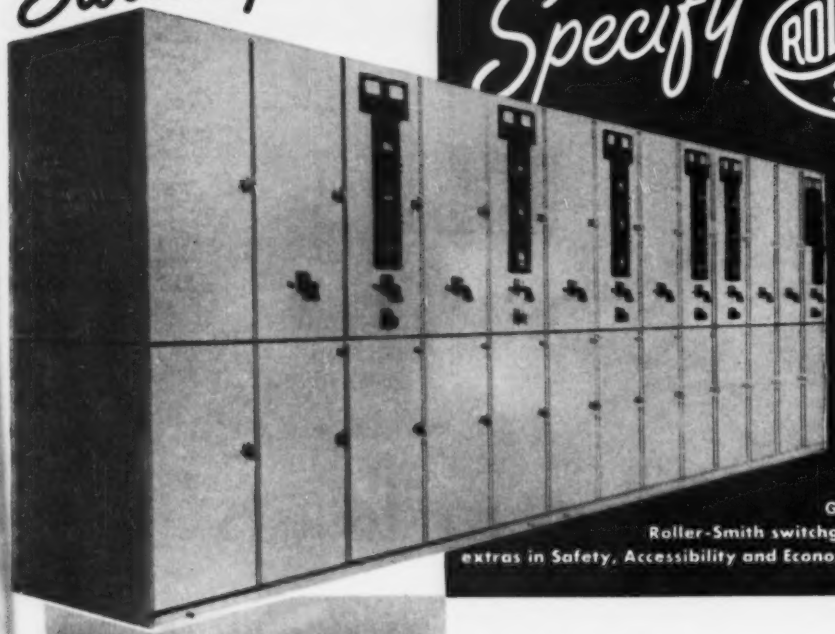
MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

Bulletin 90-2, "Supervisory Instruments for Power Generation."

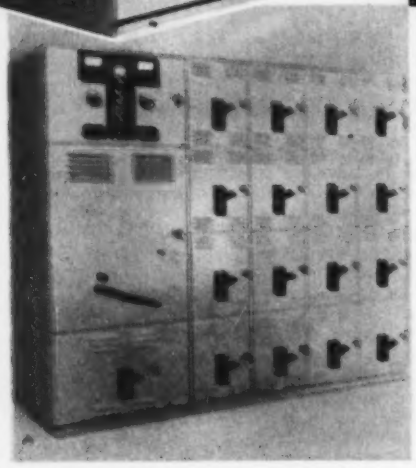
in Switchgear...

EXTRAS COUNT!

Specify ROLLER SMITH



Get *all the extras*
Roller-Smith switchgear provides . . .
extras in Safety, Accessibility and Economy of operation.



● **SAFE** All equipment is metal enclosed . . . weather proofed when required . . . built to NEMA and AIEE standards for safe, dependable performance. The "up-to-the-minute" design of Roller-Smith switchgear assures *extra* safety for operators.

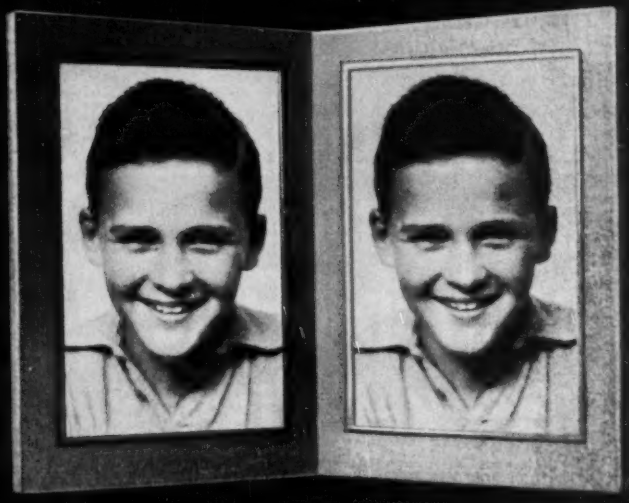
● **ACCESSIBLE** All sections of RS switchgear are easily accessible for quick inspection and adjustment. This cuts maintenance time to a minimum . . . makes it easier to do a thorough job.

● **ECONOMICAL** All Roller-Smith equipment is precision-built according to your specifications . . . tested *before* you get it. When you specify Roller-Smith, you can count on *extra* long, trouble-free operation with less "down time" for repairs.

Consult your nearest Roller-Smith representative, or write to us for catalogs which fully illustrate and describe our complete line of low voltage draw-out; moderate duty, vertical lift Metal Clad; and heavy duty Metal Clad switchgear.

ROLLER-SMITH CORPORATION
Bethlehem, Pennsylvania

ROLLER SMITH



Identical Twins?

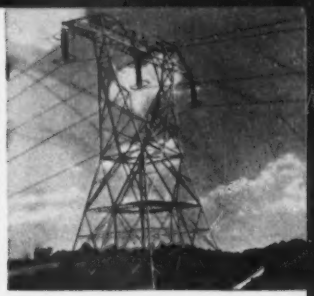
"THERE AIN'T NO SUCH ANIMAL!"

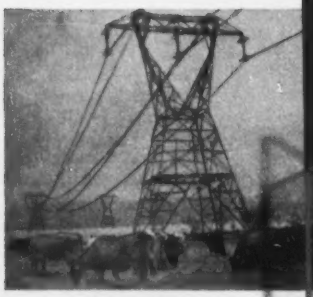
THESE handsome twin brothers may appear identical even to their parents but, should you make a careful physical comparison test, the difference would be more than apparent . . . Similarly, your engineers realize, as we do, that despite close resemblance no two transmission lines are exactly alike—therefore transmission towers supporting these lines must be designed with location and purpose in mind.

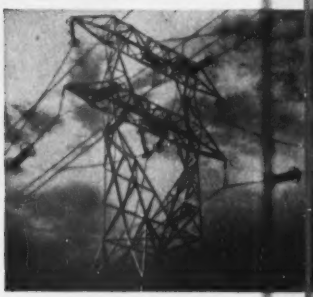
Glad to demonstrate how our four decades of experience in building towers for any and all conditions of terrain and load can be applied to your power transmission problems.

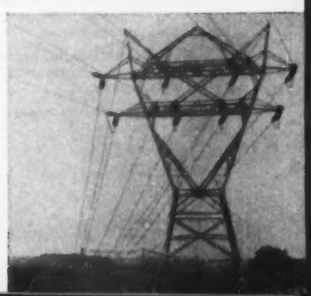
BLAW-KNOX DIVISION OF BLAW-KNOX COMPANY
2013 Farmers Bank Building, Pittsburgh 22, Pa.

BLAW-KNOX
TRANSMISSION TOWERS









"We Tested Them and Found That Fusetron DUAL-ELEMENT Fuses *actually* Do Prevent Needless Shutdowns"

H. T. Walker, Chief Inspector, General Insulated Wire and Cable Co., Paterson, New Jersey

You too can profit by Mr. Walker's Experience

By taking advantage of the 10 POINT PROTECTION of FUSETRON Dual-Element Fuses

1. *Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

"We have a 3 phase, 3 circuit switch panel controlling a resistance type heat treating furnace. In this switch we formerly installed nine 600 amp. 250 volt renewable fuses.

"These fuses, however, heated excessively and were blowing as often as once a day. To stop these blows we even tried out using 800 ampere links but it didn't do any good. We still had fuses blowing.

"As a test we installed three 600 amp. Fusetron Fuses in one circuit. That was in May, 1947.

"The first and only blow we had on these Fusetron fuses was in April 1948—one year later. This blow was apparently caused by the heating of the ordinary fuses in the other two circuits.

"The shutdown caused by this blown Fusetron fuse woke us up to the fact that the test we had made proved that Fusetron dual-element fuses actually do prevent needless shutdowns.

"Since then we have used only Fusetron fuses in this switch and our needless shutdown troubles have disappeared."

H. T. Walker, *Chief Electrician*
Cresent Insulated Wire and Cable Company
Trenton, New Jersey

Don't Risk Losses in Your Plant

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

Delay may cost you more than replacing every ordinary fuse with a FUSETRON dual element Fuse — but by passing the word along that all purchase and stock records should call for FUSE-TRON dual element fuses, you have action that begets money saving.

SEND THE COUPON FOR MORE FACTS

BUSSMANN Mfg. Co. (Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me complete facts about FUSETRON dual-element Fuses.

Name _____

Title _____

Company _____

Address _____

City & Zone _____ *State* _____ 1252

Joslyn

JUNIOR LUMINAIRES

FOR Improved

RESIDENTIAL STREET LIGHTING

Controlled illumination with attractive enclosed units at low cost

1 Narrow asymmetrical light pattern for residential streets

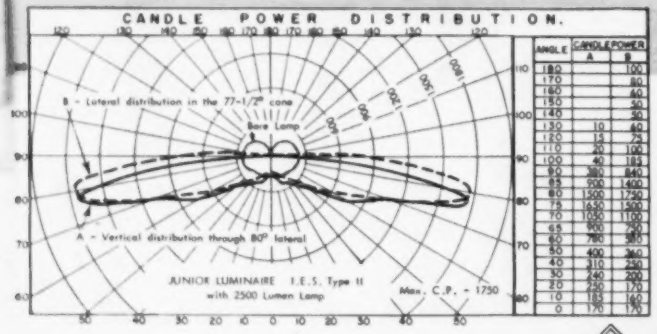
2 Totally enclosed glassware unit —die cast aluminum head—Alzak* aluminum reflector—Joslyn wedge-band gasketless glassware seal—Holophane refractor or rippled globe

3 Combines the advantages of a larger luminaire in a small, compact, less expensive unit

4 Designed also for top mounting with die cast aluminum or D. P. porcelain heads

*Manufactured under Aluminum Co. of America patents

Available for **I. E. S. TYPES II, II Four-Way, IV AND V LIGHT DISTRIBUTIONS with 1000 or 2500 lumen lamps**


CANDLE POWER DISTRIBUTION.
B - Lateral distribution in the 77-1/2° cone
Bare Lamp
A - Vertical distribution through 80° lateral
JUNIOR LUMINAIRE I.E.S. Type II
with 2500 Lumen Lamp
Max. C.P. - 1750

ANGLE	CANDLE POWER A	B
180		100
170		80
160		60
150		50
140		50
130	10	60
120	15	75
110	20	100
100	40	185
90	300	840
85	900	1400
80	1500	1750
75	1650	1500
70	1050	1100
65	900	760
60	780	580
50	400	360
40	310	250
30	240	200
20	220	170
10	185	160
0	190	170

Complete Line Equipment

Joslyn

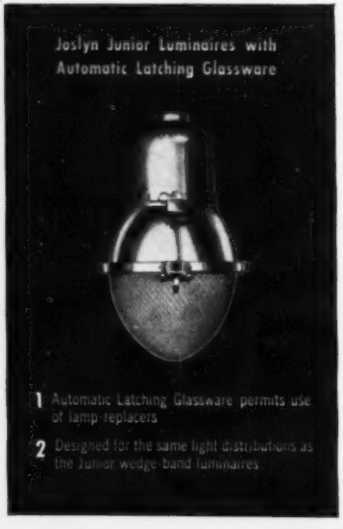
MFG. AND SUPPLY CO.

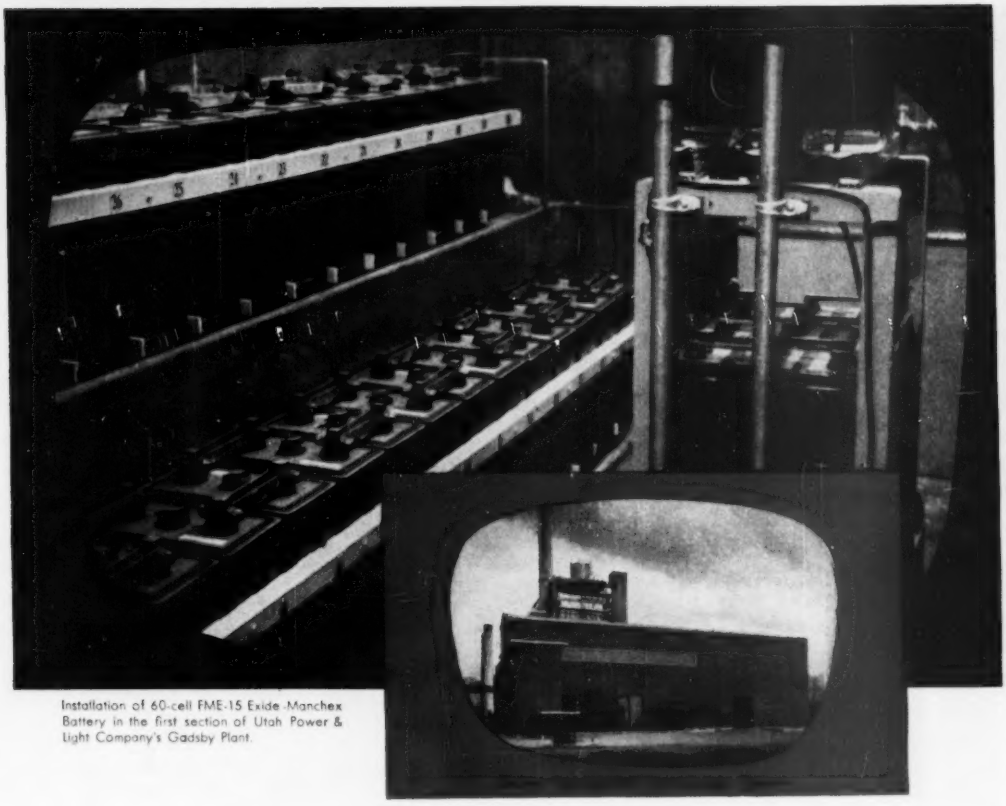
20 North Wacker Drive • Chicago 6, Ill.

BRANCH OFFICES IN PRINCIPAL CITIES

The Joslyn Co. • The South East Joslyn Co. • Southern Joslyn Co. • Joslyn Southwest Co. • Joslyn Pacific Co.

Now **Also Available**


Joslyn Junior Luminaires with Automatic Latching Glassware
1 Automatic Latching Glassware permits use of lamp replacers
2 Designed for the same light distributions as the Junior wedge-band luminaires



Installation of 60-cell FME-15 Exide-Manchex Battery in the first section of Utah Power & Light Company's Gadsby Plant.

In Gadsby plant of Utah Power & Light Company

Exide-Manchex BATTERIES

Largest steam-electric generating station in the area! Yet this important development is but part of a vast expansion program of Utah's great power company. Since 1945 some 1400 miles of rural lines have been completed, making electricity available to 97% of the farms in the area. More than 40,000 new customers have been added, and the list is growing fast.

The Gadsby Station consists of two plants—one completed in 1951, the other scheduled for this year. The combined capacity is 141,000 kw. Equipment is modern throughout and includes the largest turbo-generators in this section of the country. Standby power for switchgear operation and other services is provided by Exide-Manchex Batteries, which assure:

POSITIVE OPERATION: Dependable performance at ample voltage with no switchgear failures.

INSTANTANEOUS POWER: High rates for switchgear operation with adequate reserve power for all other control circuits and for emergency lighting.

LOW OPERATING COST: Extremely low internal resistance.

LOW MAINTENANCE COSTS: Water required about twice a year. No change of chemical solution during life of battery.

LOW DEPRECIATION: Sturdy, long-life construction.

GREATER CAPACITY in a given amount of space avoids overcrowding.

• • •

Various sizes and types of Exide Batteries, up to 100 ampere hours capacity, are available in plastic containers.

Exide-Manchex is your best battery buy for all control and substation services.

THE ELECTRIC STORAGE BATTERY CO.
Philadelphia 2

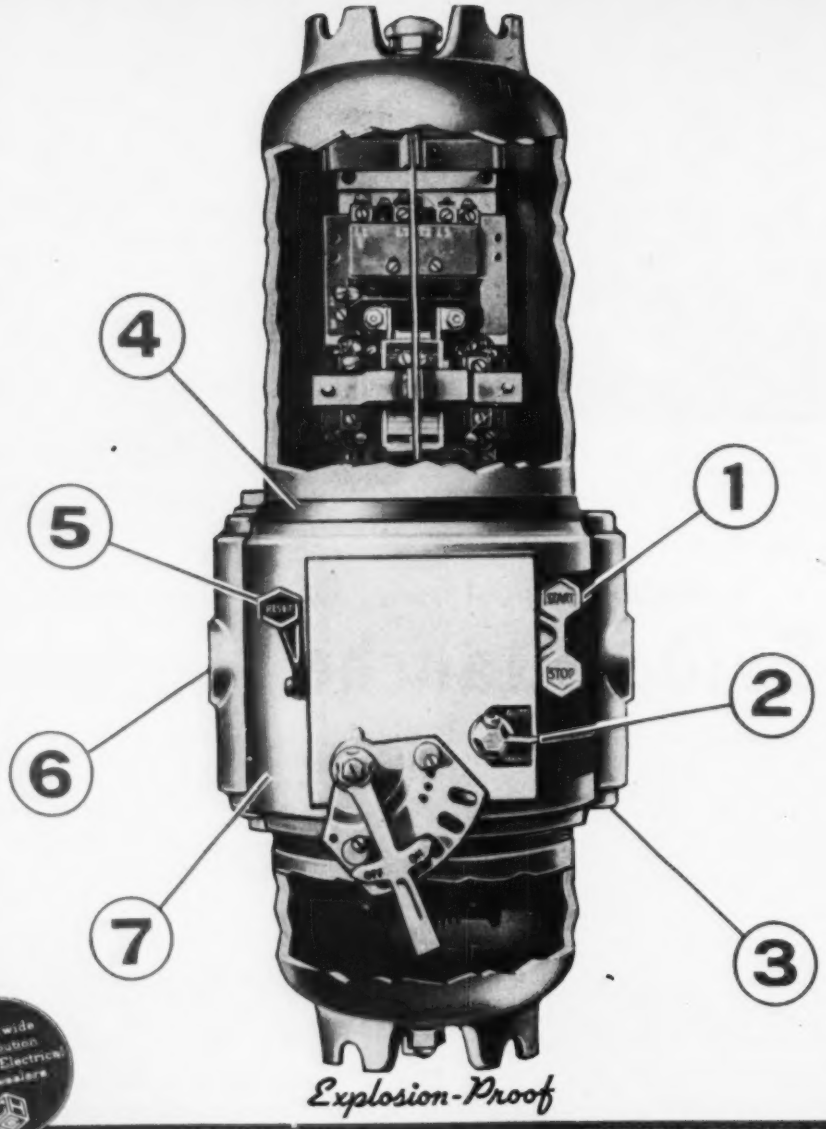
Exide Batteries of Canada, Limited, Toronto

"Exide" and "Manchex" *Reg. T.M. U.S. Pat. Off.*

1888...DEPENDABLE BATTERIES FOR 64 YEARS...1952

7 important NEW features

... to the many basic advantages of



Explosion-Proof

CONDULETS • **TRAFFIC SIGNALS**

A Nationwide Distribution Through Electrical Wholesalers

have been added

CROUSE-HINDS Type EPC

motor starter and circuit breaker CONDULET *

You get all of them on the Model M52

Model M52 EPC is the most flexible explosion-proof line starter and circuit breaker enclosure ever produced. The addition of 7 new features to the proven basic advantages of the EPC construction assures the greatest ease of installation and maintenance.

The exclusive basic advantages of the EPC Condulet have made it the world's leading enclosure for housing motor starters, circuit breakers and combinations for use in hazardous locations.

The basic advantages are:

EASY INSTALLATION . . . The use of a strong light-weight aluminum alloy and the unique three-section design makes it practical for an electrician and his helper to install the largest housing without the use of costly lifting equipment. The internal devices can be easily removed for pulling in the wires.

THREADED JOINT CONSTRUCTION . . . All joints are threaded. All operating shafts and bushings are thread-in-thread construction. This insures maximum safety, easy inspection and maintenance, and maximum corrosion protection.

FLEXIBILITY . . . A large number of different enclosures can be assembled from the wide variety of sizes of bodies and covers. They are not only used for circuit breakers and starters but have proven adaptable for many other types of electrical equipment. The body has numerous conduit hubs for flexibility of installation.

COST AND TIME SAVINGS . . . The outstanding advantages of the unique EPC Condulet over conventional explosion-proof enclosures all add up to lower installed cost and lower maintenance cost.

All of these advantages have been available for years.

Now Crouse-Hinds offers you 7 new improvements to underline the basic advantages of type EPC Condulets and to save you more dollars and more man-hours than ever before.

1. **Built-in Push button stations** available on line starters and combinations of line starters with circuit breakers — START — STOP, FOR — REV — STOP and HIGH — LOW — STOP stations for regular, reversing, or two-speed starters.
2. **Built-in selector switch** is available on line starters and combinations of line starters with circuit breakers. Normally supplied marked HAND — OFF — AUTO or JOG — RUN — OFF, three-position style. Two-position selector switch or combinations of selector switch with START — STOP station can be supplied.
3. **Back conduit entrance** can be supplied by drilling and tapping the boss in the center of the back . . . in addition to the four regular top and bottom hubs.
4. **Protective Neoprene gasket** is available for the upper cover joint. Where EPC Condulets are exposed to unusually severe weather or corrosive conditions, this gasket provides additional protection.
5. **A new RESET lever with threaded shaft,** rotating within a threaded bushing, provides easier and more positive operation of the reset mechanism.
6. **Horizontal through-feed conduit entrances** are provided by drilling and tapping bosses on the sides of the Condulet body.
7. **Greater ease in wiring** is provided by increased height in the center body section and by universal use of open framework mountings for circuit breakers and starters in the new model M52 EPC Condulets.

Model M52
Type EPC Explosion-Proof Condulet in 7, 9, and 11-inch body sizes

Send for YOUR copy of Bulletin 2634 →

* CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

OFFICES: Albuquerque – Birmingham – Boston – Buffalo – Chicago – Cincinnati – Cleveland – Dallas – Denver – Detroit – Houston – Indianapolis – Kansas City – Los Angeles – Milwaukee – Minneapolis – New York – Philadelphia – Pittsburgh – Portland, Ore. – San Francisco – Seattle – St. Louis – Tulsa – Washington, D.C. RESIDENT REPRESENTATIVES: Albany – Atlanta – Baltimore – Charlotte – New Orleans – Richmond, Va. Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.

AIRPORT LIGHTING • FLOODLIGHTS

NEW UTILITY STATIONS C-E EQUIPPED

Includes stations placed in operation since the war (in white) and those under construction or being engineered.

TIDD • JENNISON
CECIL LYNCH • HAVANA
MEREDOSIA • PERMIAN BASIN
O. H. HUTCHINGS • REX BROWN
HICKLING • B. C. COBB
RUSSELL • SEWAREN
POSSUM POINT • CUTLER
PORT JEFFERSON • WHITE RIVER
POTOMAC RIVER • GADSDEN
W. SPRINGFIELD • WOOD RIVER
DAN RIVER • LAKE CATHERINE
HARRY NEWMAN • JIM HILL
HUTCHISON • YATES
DUNKIRK • TITUS • LEE
CONTRA COSTA • HAWTHORN
NINEMILE POINT • EDGE MOOR
PALATKA • JOHNSONVILLE
DANSKAMMER • BECKJORD
HIGHGROVE • PLANT X
BLACK DOG

ALBANY

MERAMEC
LAKE CREEK
JOPPA
HENNEPIN
URQUHART
EASTLAKE
OAK CREEK
ETIWANDA
AURORA
KINGSTON
BARRY
SUWANNEE RIVER
NELSON
SAGUARO
SANDOW
MULLERGREN
WILMINGTON
PORTSMOUTH
MILLIKEN
JOHN SEVIER
VERMILLION
GALLATIN

NEW ALBANY GOES INTO

The Niagara Mohawk Power Corporation recently passed another milestone of progress in its extensive power expansion program when the New Albany Steam Station was placed in service.

The first of four 80,000/100,000 kw turbine generators which comprise the first section went on the line on October 7, 1952. The second unit was placed in service on November 15th, and the two others are scheduled for service in 1953 and 1954. Ultimately it is planned to add four more units which may be of even larger capacity.

Located at Glenmont, N. Y., on the West shore of the Hudson River about 1½ miles south of the Albany city line, this fine new plant is the first modern steam generating station to be put in service in the Eastern Division of the Niagara Mohawk Power Corp. It is conveniently situated on the transmission line which passes through the center of New York State and thence south to New York City.

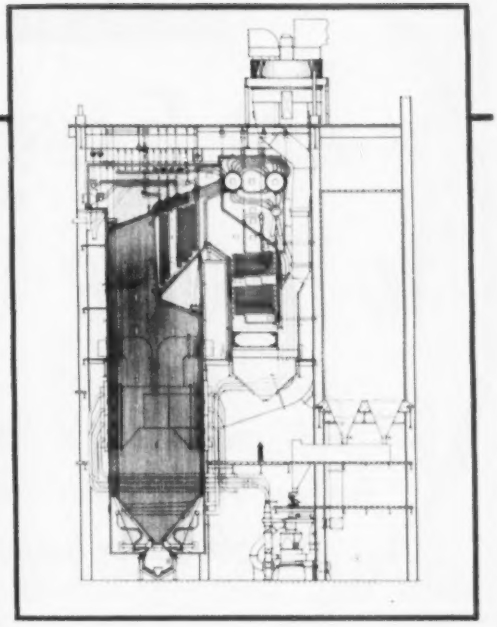
Both of the turbine generators now in service, as well as the two others now under construction, are served by C-E Steam Generating Units a cross sectional elevation and brief description of which appear on the opposite page.

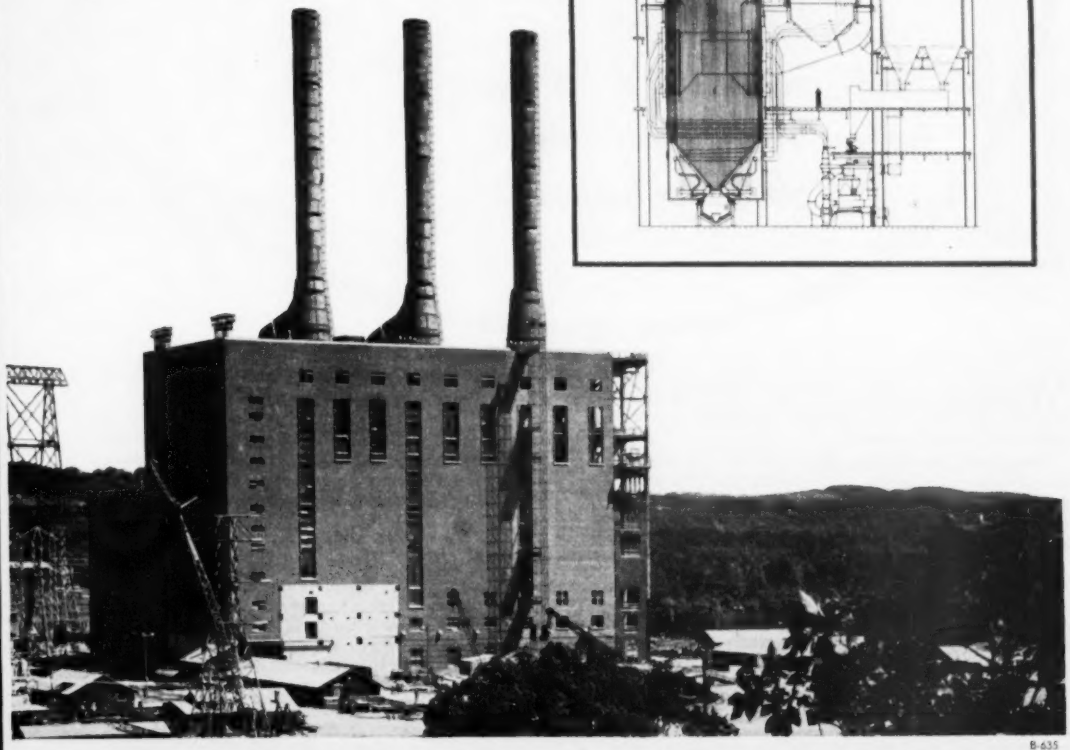
C-E

COMBUSTION
200 MADISON AVENUE, NEW YORK 16, N. Y.

STEAM STATION SERVICE

The C-E Unit shown at the right is one of two such units now in service at the Albany Station. Two more are under construction. These units are of the radiant-reheat type with the reheater section located between the primary and secondary superheater surfaces. A finned tube economizer is located below the rear superheater section and regenerative air heaters follow the economizer surface. Pulverized coal firing is employed using bowl mills and vertically-adjustable, tangential burners. Each unit serves an 80,000/100,000 kw turbine generator operating at a throttle pressure of 1450 psi and a temperature of 1000 F, reheated to 1000 F.





B-635

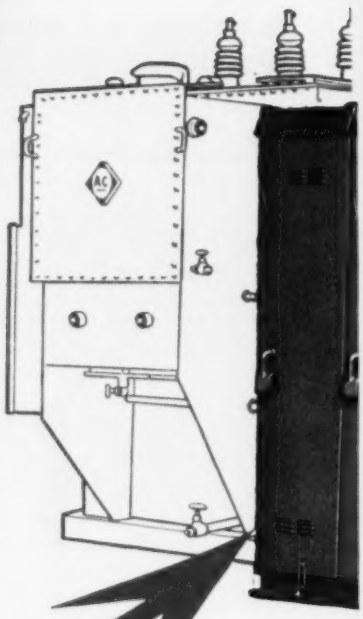
ENGINEERING—SUPERHEATER, INC.

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

MULTI-CIRCUIT

Unit Substations

Are Easy to Double-End



Now You Can Install
A-C Unit Substations That Are Planned for Easy Future Double-Ending Without Service Interruption!

WHEN LOAD GROWTH demands additional power, or when you want the added reliability of two transformers, the Allis-Chalmers Unit Substations you install today will be easy to double-end.

Your line crew will find all mechanical and electrical connections easy to make . . . the transformer throat and switchgear bus easy to align. That's because sufficient mechanical flexibility is built into the throat to permit realistic tolerances in concrete base construction.

Design Aids Quick Field Assembly

Pre-drilled bus extensions are accessible and flexible enough to be consistent with throat construction. There are no compound-filled joints requiring melting, chipping, cracking, or scraping. Just apply no-corona tape and insulating tape to finish the job.

Double-ending is easy also in terms of system operation. When planned from the initial installation, double-ending can be accomplished with no interruption in power service to your customers. Even on substations not planned initially for double-ending, the job can be done with minimum outage.

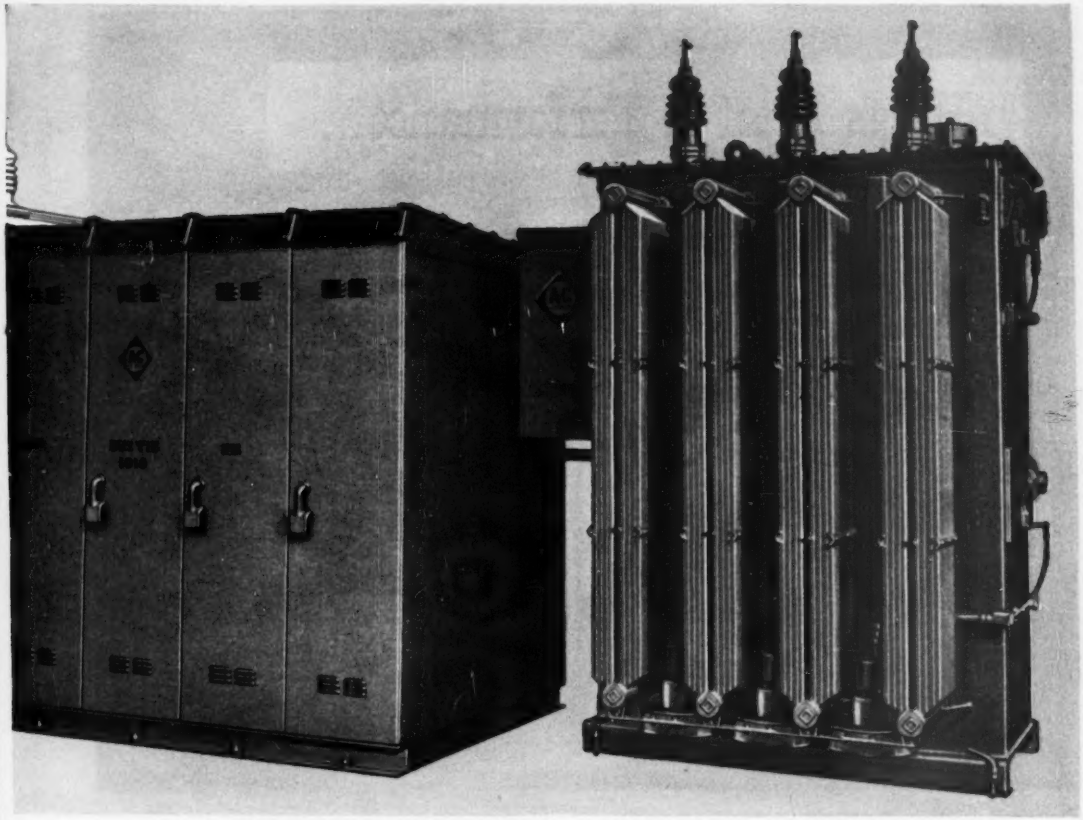
Because Allis-Chalmers Unit Substations are designed to grow with your system, they are a convenient answer to the growing distribution problem . . . to the ever-increasing demand for power and yet more power. They are simple to specify, neat and modern in appearance, and easy to expand.

You Save These Five Ways:

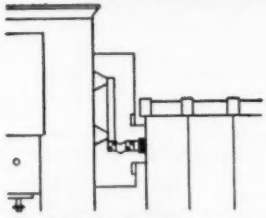
(1) Original equipment cost is low; (2) compact construction reduces space requirements and real estate costs; (3) pre-wired unit design speeds installation; (4) maintenance is quick and economical because of improved accessibility; and (5) you purchase only the equipment you need *now*, deferring additional expenses until load growth demands the expenditure.

For the full story on what Allis-Chalmers Unit Substations can mean in your distribution system, call your nearby A-C representative, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3729

ALLIS-

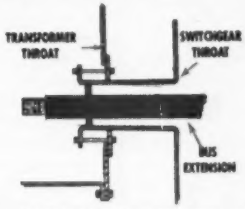


Here's Why It's Easy to Double-End MCS's



1 THE THROAT OPENINGS of all substation transformers, regardless of rating, are the same height as switchgear throat opening. This standardized throat location permits easy addition of a new transformer to the switchgear end of an installed Allis-Chalmers Unit Substation . . . simplifies and speeds field assembly.

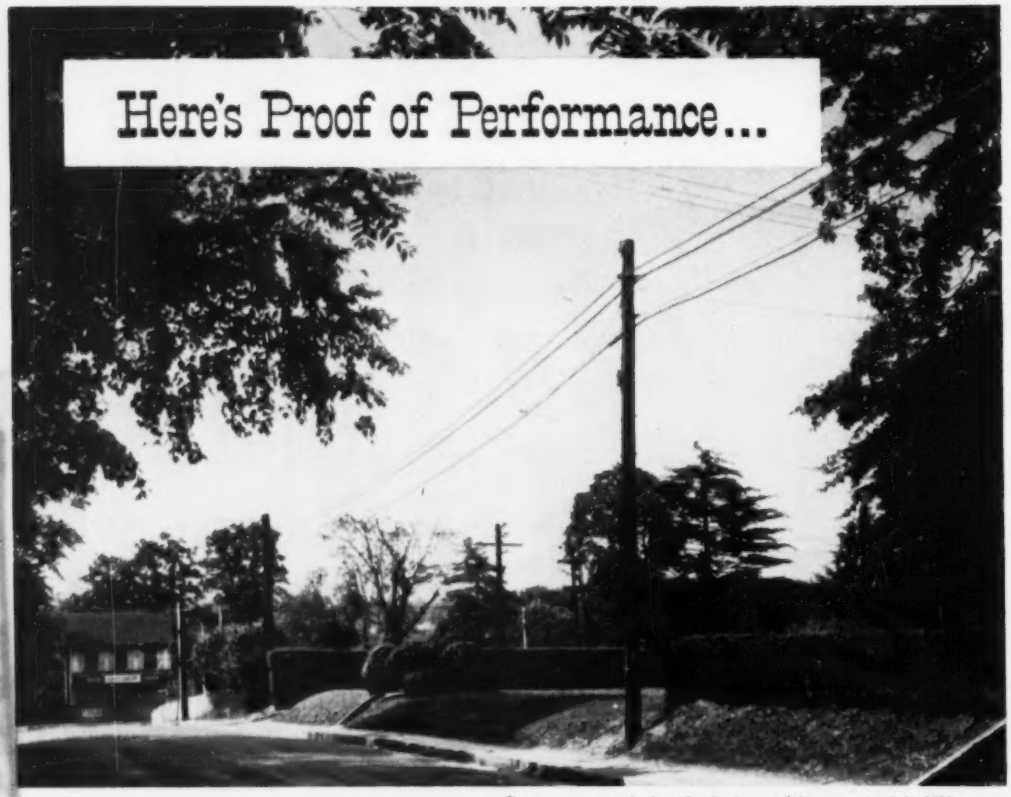
2 FEEDER UNITS are jig built so that each feeder cubicle is exactly like every other one. Bus extension openings, control wiring openings . . . even small screw holes . . . are pre-cut in jigs. This careful, uniform construction makes addition of a main breaker easy . . . assures easy alignment of the new transformer.



3 MECHANICAL AND ELECTRICAL connections are easy to make. Bus connectors and transformer throat are flexible enough to compensate for minor irregularities in concrete surfaces. Silver-plated, pre-drilled bus extensions are easy to bolt together. No-corona tape and insulating tape finish the joint.

CHALMERS

A-C ALLIS-CHALMERS



These pressure-creosoted poles on Paradise Avenue in Baltimore were installed in 1930.

Chesapeake & Potomac is counting on 40 years of service from its 39,000 pressure-creosoted poles in Baltimore

● When supplies of native chestnut poles began to diminish rapidly in the 1920's, the Chesapeake & Potomac Telephone Co. of Baltimore City turned to pressure-creosoted southern yellow pine.

Today, the Company has 39,000 of these pressure-creosoted poles in its area, and is using them exclusively in replacements and extension of service to new subscribers. The first pressure-creosoted poles went into service in 1929, and the Company estimates service life will be at least 40 years.

Inspections of the older pressure-creosoted poles have shown such good results that detailed periodical inspections are not considered necessary or economical at this time.

When you choose a wood preservative, let long service records like this be your guide. They are the main reason why the wood preserving industry is using Creosote Oil at the rate of more than 200 million gallons a year.

Creosote Oil contains not one but many compounds whose toxicity and permanence ward off attack by such wood destroyers as termites, fungi, dry rot and marine borers.

When you use treated wood, be sure it is pressure-creosoted with U·S·S Creosote Oil. It is the product of continuous processing in the world's largest tar distillation plant. For complete information, contact our nearest Coal Chemical sales office or write directly to United States Steel Company, 525 William Penn Place, Pittsburgh 30, Pa.

U·S·S CREOSOTE OIL

2-1279

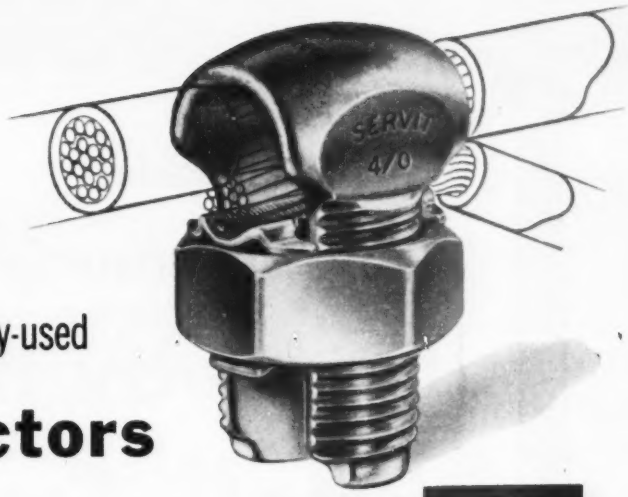
UNITED STATES STEEL

Why are these

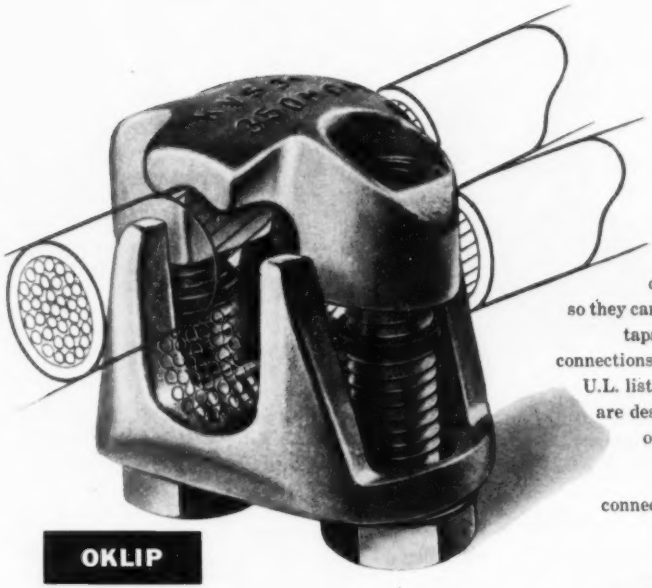
the most widely-used

connectors

in America?



SERVIT



OKLIP

Because Burndy Servits and Oklips are *engineered* of high-strength alloys – to provide the high mechanical strength that assures sound electrical connections. Because they're compact – easy to install, easy to tape. Because they withstand overload, vibration stresses, corrosion conditions, and high tightening torque – so they can be used *over and over again* for splices, taps, deadends, light or heavy-duty service connections – indoors or outdoors. Because they're U.L. listed. Because Servit and Oklip variations are designed to accommodate any combination of copper, aluminum or steel conductors.

For long years of trouble-free service connections, it pays to *specify* Burndy Servits and Oklips. *And be sure you get them!*

ALWAYS . . . consult Burndy Catalog 50 – your basic source of all connector information.

BURNDY

53-2 **BURNDY ENGINEERING COMPANY INC.,** NORWALK, CONNECT. **BURNDY CANADA LTD.,** TORONTO 8, ONT.

Dependable Communications —by the Bell System

In recent months the tens of thousands of miles of Bell System intercity private line services for power, pipe line and railroad companies were on the job 99.79 per cent of the time.

This high degree of reliability is made possible by a large force of trained specialists in the field. These men are on the job 24 hours a day, 365 days a year. When there is an interruption in service, they move in rapidly to restore it.

In most cases, they can quickly set up alternate routings in emergencies because of the Bell System's nationwide network of wire, cable and microwave.

• • •

For good, dependable communications get in touch with your nearest Bell Telephone Company representative. He will be glad to study your communications problems and requirements without charge and recommend service that will meet all of your needs.

PRIVATE-LINE TELEPHONE

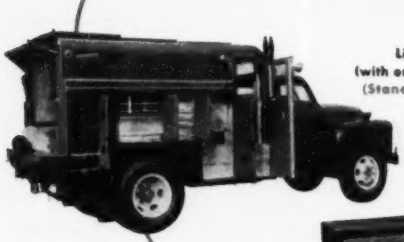
TELETYPEWRITER

MOBILE TELEPHONE

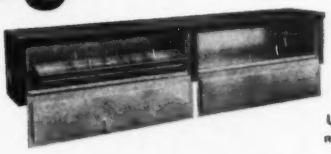
METERING CHANNELS

BELL TELEPHONE SYSTEM

The name for "utility" in Utility Bodies



Line Construction Bodies
(with or without crew compartments)
(Standard or Low Floor Design)

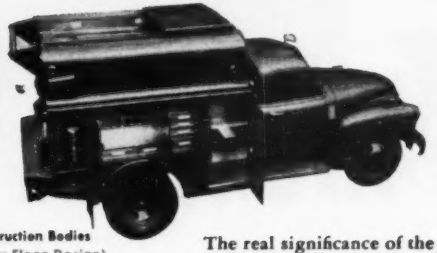


Utility compartment assemblies

New Series 2100 all-hydraulic Aerial Ladder

Heavy-Duty Hydraulic Towers

HOLAN



Light Line Construction Bodies
(Standard or Low Floor Design)

General Service Bodies

The real significance of the name HOLAN on a Utility Body lies in the engineered manufacturing that incorporates the newest, the best and ALL of the special features which insure true "utility" to the user. Maximum usefulness, based on the line crew or servicemen's actual needs in each utility assignment, is engineered into every Holan unit . . . whether it's for light or heavy line construction, with or without crew compartments, with standard or low floor, pole handling rigs, towers, ladders, crew carriers or light general service bodies. The many utility companies using Holan equipment can tell you how this pays off on the job.

There are detailed spec sheets for every Holan unit

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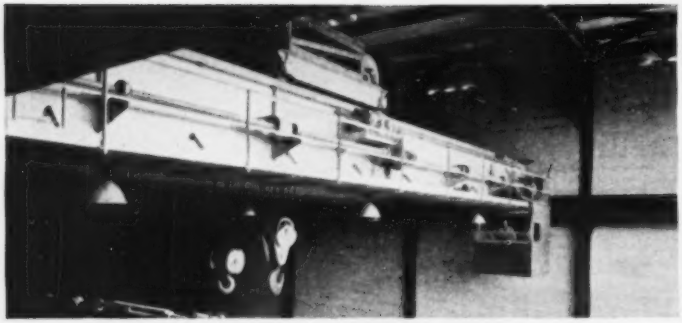
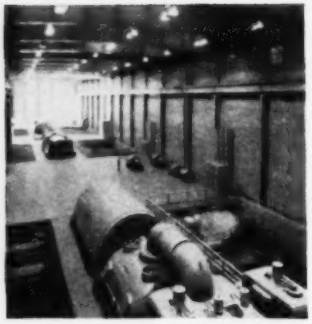
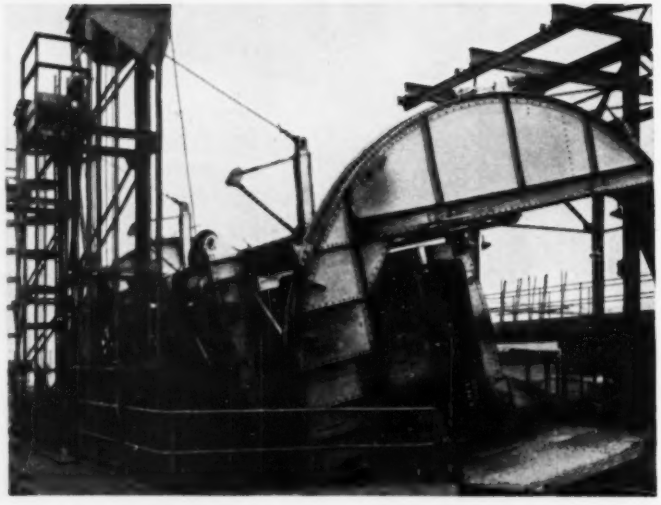






It's just as easy TO GET THE RIGHT WIRE ROPES!

Despite the highly efficient equipment in the power producing field, it is not uncommon to find the wrong wire ropes on many types of rope-using machines around power plants.

This means, of course, that the ropes wear out faster than they should, rope expense is unnecessarily high, and costly rerigging and down time is increased.

But these troubles can now be greatly reduced. Bethlehem offers a service that points the way.

At your request Bethlehem will send an engineer to make a full analysis of your rope applications. He will study the machines that are used at your plant — indoors and outdoors. He will check the ropes you have, and if changes are needed, he will, in your interest, be perfectly frank. This survey is wholly without cost or obligation on your part.

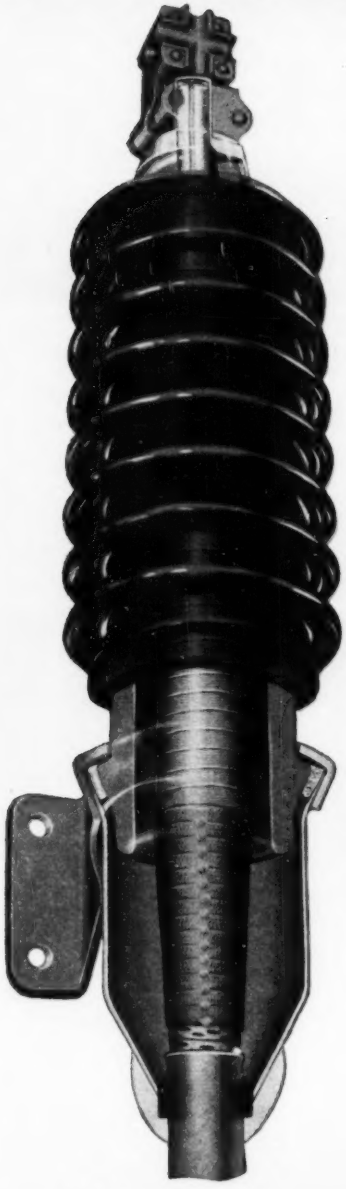
Over and over it's been proved that the *right* wire rope pays. And it's just as easy to get the right type, size, and grade as to make the wrong choice and run head-on into trouble.

If you operate such specialized machinery as car dumpers, ash disposal units, skip hoists, cableways, scrapers, turbine cranes, etc., ask a Bethlehem engineer to visit your plant and analyze your rope needs. Remember, he is a specialist, long trained in his field; his services can be invaluable. And let us repeat — the study he makes won't cost you a penny or obligate you in any way.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor*: Bethlehem Steel Export Corporation

STRESS RELIEF CONES



improve the electrical characteristics of high voltage cable terminations

Stress relief cones reduce the unit electrical stress in the cable insulation at the end of the grounded sheath. They increase the overall internal dielectric strength and reliability of the cable termination.

Stress relief cones are recommended for all shielded cables and particularly for single conductor lead-covered and three-conductor shielded cables operating at 12 Kv. and higher voltages.

For compound-filled potheads on paper or varnished cambric insulated cables, a double cone is built up of half-lapped varnished cambric tape. The lower slope is wrapped with copper tinsel braid, tucked under the bell at end of lead sheath and soldered to the lead sheath and/or to the cable shielding tape. *On rubber insulated cables use Nozone rubber tape and TINNED copper tinsel braid.*

For gas and oil filled potheads, insulating tape is applied OVER the ordinary stress cone to compensate for the absence of solid compound and provide the necessary electrical strength.

Specify and order G & W POTHEADS with stress relief cone material in unit package kits. **The correct amount of proper tape and shielding braid is supplied in convenient form — clean, dry and ready for use. Varnished cambric tape and coppper tinsel braid is oil packed in sealed cans.**

G & W furnishes dimensions and instructions for stress relief cone installations, when requested on orders for potheads.

Send for Bulletin No. A52 which explains the theory of stress relief cones in potheads, and lists prices of unit kits for cables of various kinds and sizes.

G & W ELECTRIC SPECIALTY COMPANY
7780 DANTE AVENUE • CHICAGO 19, ILLINOIS, U.S.A.
Representatives in principal cities. In Canada, Powerlite Devices, Ltd., Toronto

SAVE WITH ALUMINUM CONDUCTOR

INITIAL SAVINGS—You *automatically* effect major savings when you specify aluminum conductor, because aluminum costs less than copper. Handling is easier because aluminum with equal conductivity is only about half the weight of copper.

INSTALLATION SAVINGS—Light weight aluminum conductor is easier to carry, easier to string, easier to move around. This results in faster, lower cost installations. Your *total average savings* with aluminum conductor can be as much as 25%.

SAVE MORE

WITH KAISER ALUMINUM CONDUCTOR

KAISER ALUMINUM FIELD ENGINEERS work right on the job alongside crews, give stringing assistance, suggest ways to cut costs all down the line. They keep tabs on customer schedules—help maintain Kaiser Aluminum's unsurpassed record for *on-time delivery*.

KAISER ALUMINUM SERVICE ENGINEERS make detailed studies of customer's *individual problems* with an eye to greater economies. They help coordinate specifications and designs. They conduct meetings with crews, provide sag and tension charts on request.

KAISER ALUMINUM LABORATORY SERVICE assists customers on problems requiring fundamental research—often resulting in worthwhile savings. It's one of the industry's best-equipped and staffed laboratories, backed by Kaiser Aluminum's fully-integrated facilities.

THIS COMPLETE SERVICE is available to you at no obligation when you specify Kaiser Aluminum conductor. *Act now!* A letter or telephone call is all that's required. Also request free pamphlet giving complete engineering data on new Kaiser Aluminum covered conductor—both weatherproof line wire and self-supporting Triplex cable for service drops and secondary distribution lines. Contact any Kaiser Aluminum office in principal cities, or one of our many conductor distributors. Kaiser Aluminum & Chemical Sales, Inc., Oakland 12, California.

Kaiser Aluminum

setting the pace—in growth, quality and service

NEOPRENE AND POLYETHYLENE COVERED CONDUCTOR, SOLID AND STRANDED • SELF-SUPPORTING TRIPLEX CABLE • ACSR • ALL ALUMINUM CONDUCTOR

Lowers Operating Costs

Steps up crew efficiency!

Powers-American bodies do their job faster, more efficiently, and at lower cost, because they're "*job-engineered.*" Each model incorporates design features *proved* by utilities over many years of operation, and is field-tested under actual working conditions by utility engineers *before* production! "*Job Engineered*" means long life and trouble-free service for you, whatever your utility body needs may be. Look to *Powers-American* as *your 1* source for *all* types of utility bodies and equipment.

HYDRAULIC TOWER

Available in models having ground-to-platform heights of 21', 25', and 30', for installation on chassis having 1½ ton capacity or more.

GENERAL SERVICE BODY

½, ¾, 1, and 1½ ton models. Can be equipped to meet any operating requirement.

FORESTRY BODY

For tree trimming and clearing. Also available with winch and derrick for construction work.

REVOLVING AERIAL LADDER

Can be extended to any length, spotted in forty positions throughout a full 360° revolution, and inclined at any angle from 30° to 75°. Easily operated by one man. Safe enough to support 4 times normal working load. Available in sizes having ground-to-platform heights from 23' 6" to 32' 3".

LIGHT CONSTRUCTION BODY (350)

Fold-over derrick can handle poles up to 40' in length. Underfloor winch leaves loading area clear.

"The Accepted Standard with Utilities Everywhere"

POWERS *American* DIVISION

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PUBLIC UTILITY BODIES AND EQUIPMENT

McCABE-POWERS AUTO BODY COMPANY

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There are many styles of *Powers-American* Bodies not shown here. Write for descriptive catalog today.

THE Aristocrat OF STATIONARY BATTERIES

GOULD PLANTÉ is the finest battery money can buy! In switchgear, signal and alarm systems or emergency light and power applications, these batteries with the *pure lead* positive plates have rolled up such amazing service records that they have the lowest per annum cost of any battery on the market! For utmost dependability and economy, choose Gould Planté—the Aristocrat of Stationary Batteries.

You may be able to save up to 50% on maintenance costs throughout the life of your stationary batteries by using the Gould Plus-Performance Plan. Write Gould Battery Information Headquarters for full details.

GOULD *Industrial Batteries*

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, N. J.

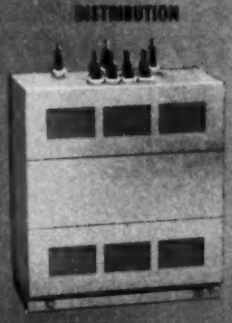
Always Use Gould-National Automobile and Truck Batteries

Designed for Economy

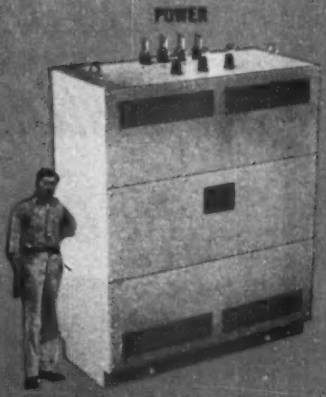
Built for Long Life

Tested for Dependability

Uptegraff *Dry Type* Transformers



Dry Type Distribution Transformer. Note large ventilation grilles.



Dry Type Power Transformer. Sizes available up to 3000 KVA-15 KV

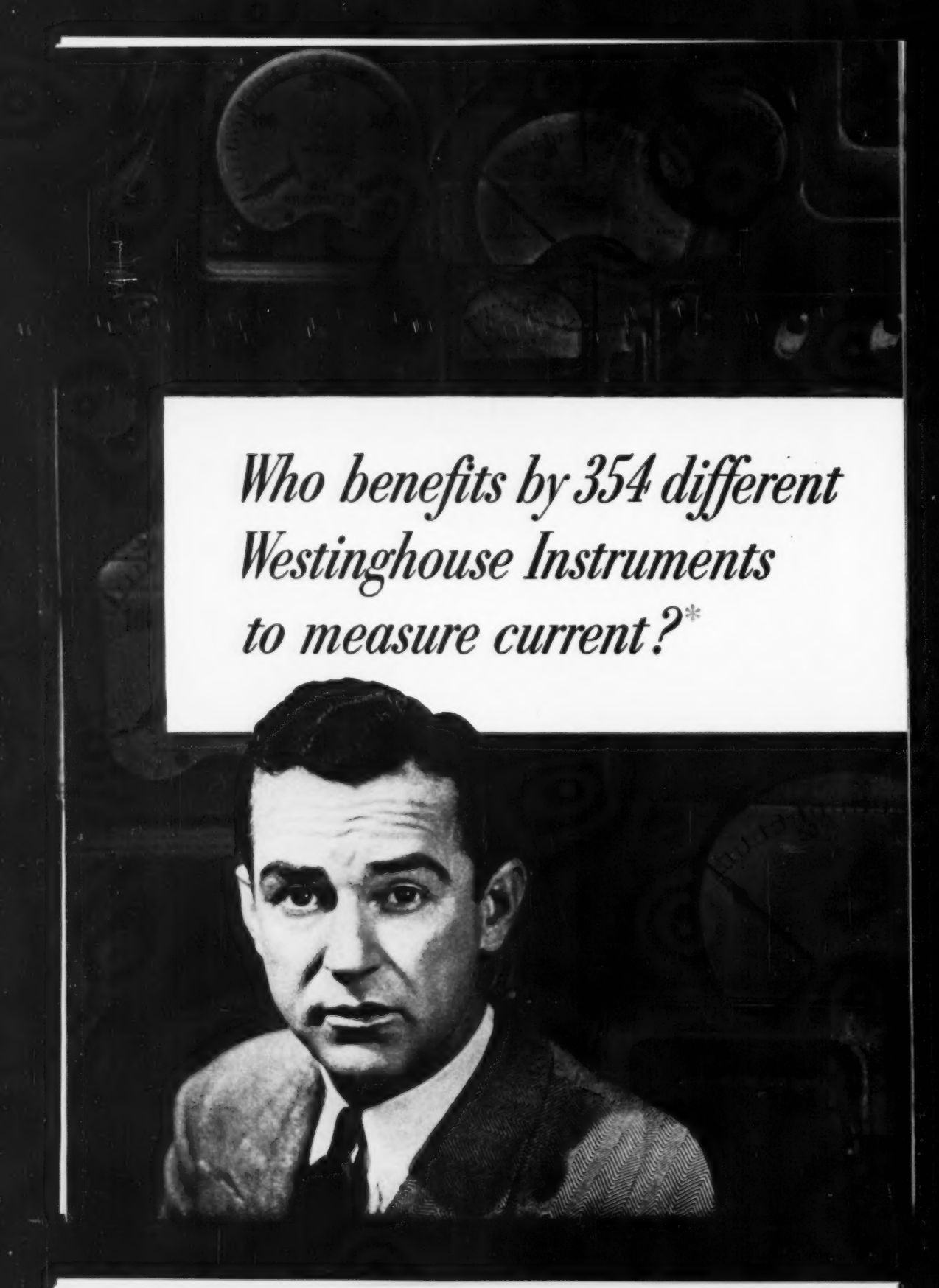
Noise-Level Tested

Every Uptegraff Dry Type Transformer must pass a noise level test before shipment.

Uptegraff Dry Type Distribution and Power Transformers are made in standard sizes and ratings up to 3000 KVA-15 KV. Features that mean long life, efficient operation and dependability are: well-ventilated coils for elimination of hot spots; integrated design of core and coil assembly for top level performance with respect to short circuit forces; class B insulation, steel and porcelain structural parts for durability.

Prompt deliveries can be arranged.

R. E. Uptegraff Manufacturing Co.
Scottdale, Penna.


*Who benefits by 354 different Westinghouse Instruments to measure current?**

Product Engineers

The wide variety of Westinghouse Instruments helps you to realize primary design objectives—to make your product look better, perform better, sell better. For any application there's extra design freedom in the unusual diversity in size, types of mounting, accuracy and styling . . . the almost unlimited variety of ratings and style combinations. And the performance of all Westinghouse Instruments meets ASA Standards.

Production Chiefs

Proper instrumentation of production machines, processes or power supply can help you to attain more production, closer quality control or lower production costs. Whether your needs involve measurement of amperes, volts, watts, vars, power factor, frequency or synchronism, there's a Westinghouse Instrument for the job. The line also includes many types to measure position, time, temperature and speed. And Westinghouse Instrument Application Engineers are ready to assist you in applying them most effectively.

Purchasing Agents

In the full line of Westinghouse Instruments, you have a complete source of supply —one responsibility—for all of your electrical measurement needs. Moreover, Westinghouse offers you faster service because all designs are keyed to chassis stocking and assembly procedures.

Benefit this way!

Here's an example. A leading pipeline company, in a radical departure from conventional pipeline instrumentation, is using Westinghouse Electrical Measuring Instruments in pumping stations for pressure and flow indications at various points on the system. The result: More efficient control without fire hazard; greater accuracy; substantially less maintenance—a big, long-range saving! So if you design a product, produce it, or buy for it . . . specify Westinghouse Electrical Measuring Instruments!

J-40420

*

The extensive coverage of Westinghouse current-measuring Instruments is further emphasized by the fact that there are 32 different instruments just to measure microamps.

For complete information about all Westinghouse Electrical Measuring Instruments, write for Booklet B-4696. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

YOU CAN BE SURE... IF ITS

Westinghouse

INSTRUMENTS

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Boston Edison Co.
Central Hudson Gas & Electric Co.
Compania Argentina De Electricidad
(Argentina)
Compania De Fuerza Del C...
De M...

PICTURES TELL THIS IMPORTANT STORY BEST!

. . . final turbine lead for 1000 F — 1850 psi installation goes in. See why Kellogg handles many of the most important hi-temperature, hi-pressure systems.

Line-up . . . perfect alinement micrometer tolerances of sections weighing tons.

Check-up . . . engineers verify the proper spacing in weld grooves and fit of backing rings.

Temperature Control . . . accurately positioned thermocouples control temperature under all conditions.

The Preheat . . . induction heating at optimum temperature assures crack-free weld.

First Bead . . . senior-engineer supervised . . . complete fusion, uniform backing ring penetration are "musts."

No Letdown . . . slag-free surfaces, uniform weld-metal deposits, constant temperatures on each successive layer.

Finished? . . . welding completed, yes . . . but then comes Radiographing and vital multiple hour stress relieving.

engineers have
better thought. It's a fact that all of the meticulous work done in the pre-fabrication of critical alloy piping sub-assemblies can be undone through improper field assembly and welding.

how evaluates
position. Adhering over the years to the principle of close integration of basic research, engineering fabrication and construction—Kellogg believes there is no better demonstration of its value than the demand for Kellogg pre-fabrication and installation of critical electric utility piping.

OTHER FABRICATED PRODUCTS including:
Pressure Vessels . . . Vacuum Vessels . . . Fractionating Columns . . . Drums and Shells . . . Heat Exchangers . . . Process Piping . . . Bends and Headers . . . Forged and Welded Fittings . . . Radial Brick and Concrete Chimneys.

for 51 years an integral part of industrial progress!

Fabricated Products Division—The M. W. Kellogg Company PULLMAN

New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris.

6 Reasons why you get greater accuracy with Bristol Series 500

RECORDING VOLTMETERS AND AMMETERS

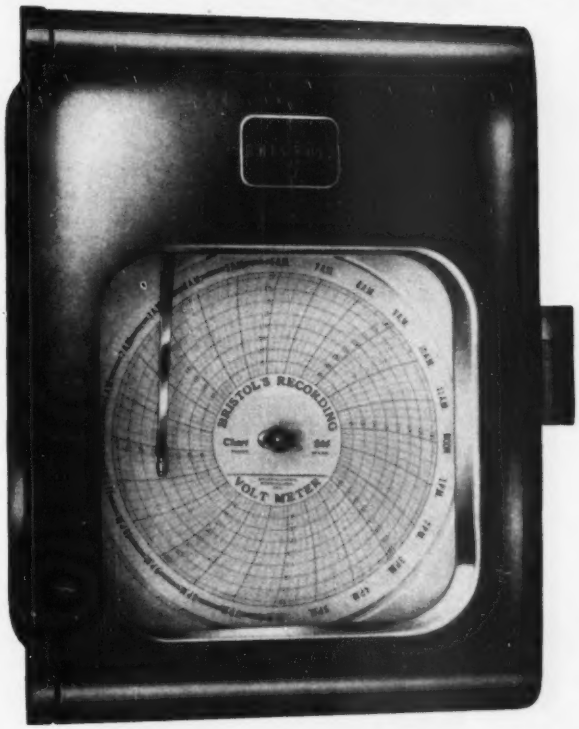
1. Low burden—the lowest burden of any round-chart recorder on the market.
2. Extremely high torque gradient.
3. Temperature compensated.
4. Shock-proof moving element mounting.
5. Leveling of instrument not critical.
6. Continuously legible recording on sudden changes—up to full scale value.

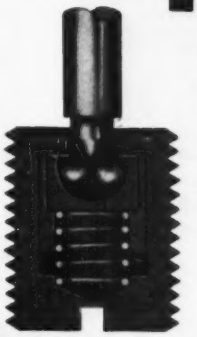
Bristol Recording Voltmeters and Ammeters use moving-iron measuring mechanisms, known for high torque . . . refined by Bristol engineers for greater accuracy and ruggedness.

Advances in electrical measurement naturally come from Bristol, experienced for nearly 60 years in building hundreds of thousands of recording voltmeters and ammeters for almost every application . . . the finest, most dependable products.

Series 500 Voltmeters and Ammeters are designed for easy use, with dust- and moisture-proof die-cast aluminum case; quick-set chart hub for easy chart changing; non-obscuring pen lifter; and snap-on chart plate.

Find out all about these superior instruments by writing for Bulletin E1111 to THE BRISTOL COMPANY, (116) Bristol Road, Waterbury 20, Conn.





Permanent mounting offered in three models: interchangeable surface and flush, surface-panel and flush panel. Note the pleasing, well-balanced appearance. Also, *portable instruments* are offered in two models: for setting on floor or table; for mounting on walls or poles and general service.

New ball-bearing suspension, loaded by a coil spring, prevents damage even under severe mechanical shock. Stainless steel bearings and shaft are almost tool hard and are corrosion-resistant.

BRISTOL

The dependable Guidepost of Industry

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

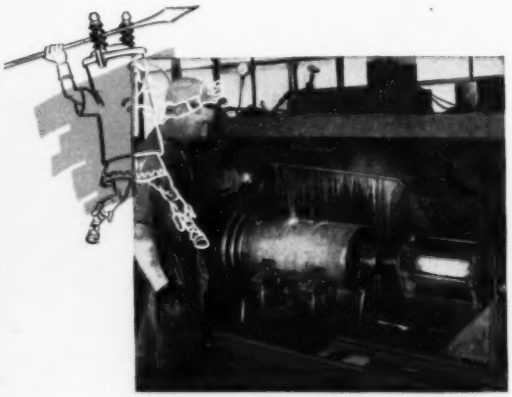
MOLONEY *HiperCore* BEST

The *"better performance"* that has come to be expected of Moloney HiperCore Distribution Transformers is not the result of chance. Rather, it is the result of long experience in the engineering, design and manufacture of transformers. This experience applied, resulted in the design of the HiperCore Transformer. Thorough testing of pilot models resulted in the transformer you receive when you order HiperCore.

But—this alone is not enough! To be sure that you get *"superior performance"* Moloney maintains a constant check during all stages of manufacture so that you know your HiperCore Transformer has been checked and double checked to insure the best operating performance possible.

Briefly, here are the testing steps every HiperCore Transformer undergoes before leaving the Moloney factory:

After the core-and-coil unit is assembled with necessary tap changers and other internal accessories, the completed unit is again tested.



All Moloney Transformer Tanks are individually pressure tested in a special spray machine before painting to make sure that they have no leaks.

MOLONEY ELECTRIC COMPANY

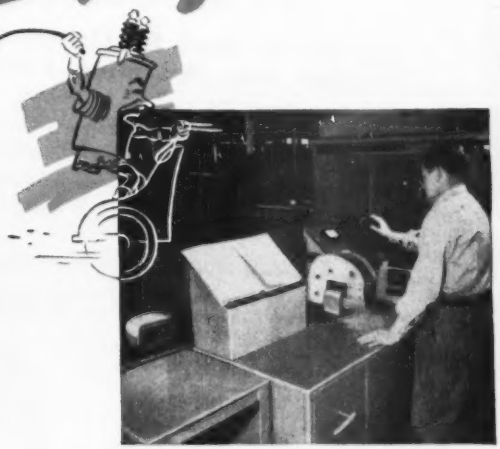
Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control

FACTORIES AT ST. LOUIS 20, MISSOURI AND TORONTO, ONTARIO, CANADA

DISTRIBUTION TRANSFORMERS

BY TEST!

Each HiperCore coil is tested for the proper number of turns in each winding and each tap position before it leaves the winding department.



After cores are wound on automatic winding machines, they are annealed and impregnated, and then tested for hysteresis and eddy current losses both before and after they are cut.

Final, NEMA Standard Tests on all transformers; no load loss, exciting current, polarity check, ratio check, dielectric tests. Transformers above 200 Kva also receive load loss, impedance, temperature rise tests.

A 3,600,000 volt surge generator, capable of applying surges equivalent to the most severe that will be encountered in operation, was instrumental in the development of the HiperCore design. Periodic sampling tests are made of transformers from the production line to insure quality control.

Because these tests are standard in the manufacture of HiperCore Transformers, they offer the following advantages:

1. **Surge-proved core-and-coil design**
2. **High short-circuit strength**
3. **Greater short-time overload capacity**
4. **Longer operating life**
5. **Less maintenance**
6. **Better voltage regulation**

Specify* MOLONEY *for better performance!

Transformers • Step Voltage Regulators • Unit Substations

BETTER PERFORMANCE
GREATER RELIABILITY
LESS MAINTENANCE

SALES OFFICES IN ALL PRINCIPAL CITIES

CHECK MOLONEY HiperCore® TRANSFORMERS

against the field for Lighter Weight, Smaller Size, Operating Advantages

CHECK THESE WEIGHTS

3 Kva LL Conventional HiperCore Transformer including oil . 120 lbs.

3 Kva CSP Class A HiperCore Transformer including oil . 140 lbs.

3 Kva CSP Class A HiperCore Transformer including oil . 155 lbs.

Easier to install — easier to store — less maintenance

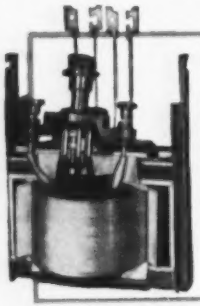
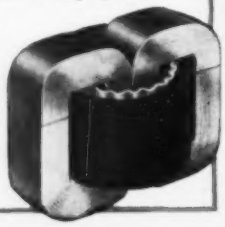
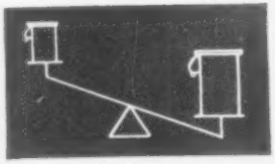


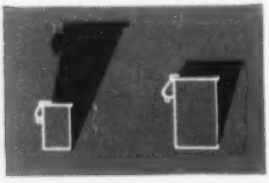
Illustration shows core-and-coil assembly. Cores are wound, annealed and impregnated, then cut into pairs of U-shaped pieces. Matching U-shaped pieces are then placed in position around the coil to complete the magnetic circuit. Core faces are cemented together. Steel bands are used to obtain tight joints.



15% TO 30% LIGHTER

because the cold rolled high permeability, oriented silicon core steel has 30% to 35% higher flux carrying capacity. This makes possible the use of smaller cores and windings. Easier to handle and install than transformers having cores of hot rolled steel, these smaller and lighter transformers take up less space on the pole, in the storeroom and on the line truck.



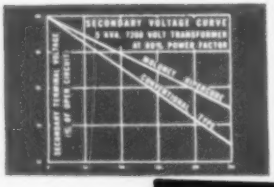


GREATER SHORT-TIME OVERLOAD CAPACITY

Moloney HiperCore Transformers have improved short-time overload characteristics which provide better peak load performance and longer life. Reduced coil mass, achieved through use of oriented steel cores, together with the extensive use of cooling ducts, results in more rapid cooling of the windings and in a lower hottest-spot temperature gradient.

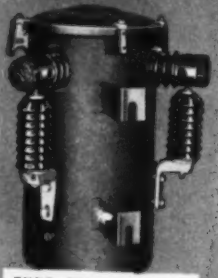
BETTER VOLTAGE REGULATION

The smaller cores of HiperCore Transformers make possible windings having lower impedance. Lower impedance provides lower internal voltage drop at all loads. This is especially important during peak load periods, since HiperCore Transformers can carry higher overloads than older types, at the same permissible regulation.

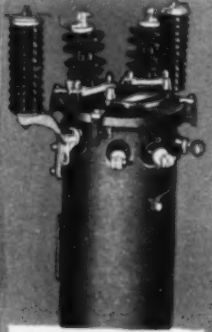


WRITE FOR BULLETIN H-305

TYPE LL—Conventional **HiperCore** Transformer manufactured in standard sizes from 3 to 100 Kva in all standard voltages below 5000 volts.



TYPE CSP—CLASS A HiperCore Transformer manufactured in standard sizes from 3 to 100 Kva in all standard voltage ratings of 5000 volts and below.



TYPE CSP—CLASS A HiperCore Transformer manufactured in standard sizes from 3 to 100 Kva in all standard voltage ratings above 5000 volts.

MOLONEY ELECTRIC COMPANY

Sales offices in all Principal Cities

FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

BETTER PERFORMANCE
GREATER RELIABILITY
LESS MAINTENANCE

Quick Starting Is Safe and Economical

The large additions of generating capacity are going to have a pronounced effect on the operating practices for existing facilities. Instead of operating all units at reduced loads after midnight and over weekends many should be shut down and then restarted as the load picks up. To make this practical, fast starts must be resorted to. What advantages are gained and risks taken by this procedure?

Probably no utility faces this situation on the same scale as Consolidated Edison Co of New York. It has the largest aggregate of steam capacity and probably the sharpest relative load reductions. Naturally that company would be early in finding an answer to the problem. In its case the contribution comes straight out of the operating forces. J. C. Falkner, manager of electric production, has been perfecting quick start techniques for several years and has presented to the ASME very comprehensive data to prove his points about quick starts of boilers and turbines from cold.

Normal superheater element life need not be shortened by one to two-hour starts if they are the high pressure drop type and firing is appropriately controlled. Nor are drum stresses necessarily greater or even so great as for long starts despite the metal thickness and the differentials between top and bottom and between cylinder and ends (improved baffling corrects the latter). More uniform vertical expansion of the whole boiler results from the sustained firing of quick starts than the intermittent firing of long starts.

Some of the evident gains from quick starting are the longer time afforded for repairs and upkeep and the saving of up to 27% in fuel consumed during the shortened starting period.

There would be little point in quick starting the boiler unless the same acceleration could be found safe for the turbine-generators. A sine qua non here is the use of turning gear to prevent distortion of the shaft. Shortening of the rolling period for the turbine hinges on the temperature (at the beginning of the start) of the integral steam chest. Single shell units usually have massive horizontal flange designs and thus should be granted more than the 30 minutes starting deemed safe for large modern high pressure turbines.

How do the makers of boilers and turbines react? In general they "go along," and their attitude is essentially one of caution. They grant that the Falkner evidence is solid and persuasive, but they remind the other utilities that Falkner felt his own way courageously but cautiously, taking temperature readings with a degree of thoroughness that may not have to be repeated by those who decide to emulate him. There are distinctive design differences however, among boilers and turbines, and these are the more critical the older the vintage. No one should plunge into quick starts without analyzing the consequences of these differences. For service continuity comes before dollar savings.

Once the effects of quick starting have been explored for existing machines then the utilities can derive full benefit from the new high efficiency capacity without sacrificing some of the gain by keeping present capacity running at partial loads rather than shutting it down and starting it up every night and weekend. This is the meaning of the trail-blazing contribution that has come out of New York, and the credit accorded Falkner by his compatriots in power production is very much deserved.

CLARA ZILLESSEN . . .

. . . Her Hopes Depend on You

Right now the number of companies preparing entries for the prize award competitions sponsored by Edison Electric Institute is a mystery. In 1949 there were only 77 entries. Last year the 150-mark was topped. This year Clara Zillessen is hoping for ever so many more.

Clara has high hopes because she has been doing promotion work for the awards ever since her retirement several years ago as advertising manager of Philadelphia Electric Co. At that time George Whitwell was committee chairman. He and the donors of the awards felt that good use could be made of Clara's publicity know-how. So she was put to work, and she was asked to stay on when Harry Restofski succeeded Whitwell.

Being feminine Clara just can't see one good reason why all companies don't enter all the competitions. As she says, "There are seven awards with 33 prizes for achievements in the commercial field of the industry. In addition there are the Matthews Valor Award and the Reddy Kilowatt Annual Report Award. All companies have a chance to win."

Clara supports her "all companies have a chance to win" statement by quoting the new rules recommended by the Awards Committee which bar all entries over 15 by 18 in. Formerly the idea prevailed that the more impressive the entry—in appearance and often in sheer weight and size—the better chance of winning it was thought to have. But under the new rules a few typewritten pages in an ordinary cardboard binder telling the story of a real accomplishment can win out. No company any longer need have the mistaken belief that preparing an entry for the contest means hours and hours of work on the part of many employees and a big chunk of the budget.

Clara's argument is a good one. At least the new rules eliminate "the big companies always win" alibi for not entering. There is no doubt that many companies have accomplishments of which they well may be proud. If these companies will not let laziness and procrastination keep them from the competitions, Clara's hopes of a greatly increased number of entries may be realized. The lady's hopes depend on you.

Honor Where Honor Is Due

Twenty months is a long time in a man's life. It can seem even longer when the man is where he doesn't want to be—at the Korean battlefront, in jail, or in some government agency. So the past 20 months must have seemed unbelievably long to Jim Fairman.

It was March 1951 when the Consolidated Edison vice president arrived at the Defense Electric Power Administration headquarters at Washington as a deputy to Administrator C. B. McManus. When he returned to Georgia in June, Fairman took over the No. 1 spot.

There has never been any indication that he sought the job. He could have rejected it as others before him had done. Instead he merely accepted it and did it. Everything that he did wasn't perfect. There were often a number of solutions to the industry's problems, and Jim took the one he thought best though others could disagree. But all in all he did a good job for the industry and a good job for his country.

At least his country openly gives recognition of this in its presentation to him of the Interior Department's Distinguished Service Award. The industry would do honor to itself to add to this recognition. For his sacrifices, leadership, and outstanding service, Jim Fairman deserves more than a much needed rest.

Sell—and Sell—and Sell

Practically every electric utility makes load forecasts. Some of the projections are really competent studies solidly based on comprehensive local data, painstakingly collected and analyzed. Of others, it is sufficient—and charitable—to say merely that they are different.

But all load forecasts, from the most competent to the most puerile, have one thing in common. Each one is premised on the duty of the utility to keep up with the growth of its load. And practically all of them stop at that. This is because they are almost exclusively the work of engineers and statisticians, minds devoted to arithmetic. The salesman's imaginative touch is lacking.

If that touch were in such projections, in proportion to the need for it in these times so determining of the future, the ultimate figures of loads one, two, five, ten years from now would be different. Instead of loads to be expected, the figures would be of loads to be achieved.

Certainly, the electric utility is under inescapable obligation to keep up with the growth of its load. But enterprise sees the obligation extending beyond that limit to cover the equal duty to sell—and sell—and sell. Only by selling will electric service grow as fast as it can—and should.

To Be Distributed and not Forgotten

When someone does a good job year after year, it is only human nature to be less impressed each time. So the industry is likely to take for granted EEI's "I Want to Know about the Electric Industry." But this booklet answering 27 questions frequently asked the institute should not be read, tossed aside, and forgotten. It is too valuable for that. It must be distributed to those who need its information. And this is a job the industry must do.

THE ELECTRICAL WEEK

The Issue's News Highlights—Hearings on New York Power Authority's application for a license to build the U. S. portion of the proposed St. Lawrence Power Project got underway in Washington last week. Although 35 intervenors are to be heard, Federal Power Commission hopes to conclude hearings within a week.

Tennessee Valley Authority has decided on the bold approach in hitting up the next (Republican) Congress for funds to continue TVA expansion. Chairman Gordon Clapp says the authority will need $1 billion in five years, exclusive of AEC requirements.

Off the Washington Wire—Mobilizers are trying to dope out a way to rush power expansion at TVA so that the agency can meet its commitments for atomic energy program (see page 92) . . . FPC has again postponed hearings on Idaho Power's application for the Oxbow project till April 13. Reason is company's new proposal for Snake River development (EW, Dec. 8, p 8) . . . Interior Secretary Oscar Chapman says he won't handle cases involving Department of Interior when he enters private law practice after Jan. 20 . . . Interested parties have been watching for Roanoke Rapids decision to come down from the Supreme Court for past two weeks. Now they expect it to come down today—Dec. 15.

Puget Sound P&L files a damage suit on Chelan County Superior Court against officers and directors of Washington Water Power, John S. Tilney of New Jersey and William J. Collins of Oregon, stockholders of Puget and J. W. Bryan and C. E. Ferguson, commissioners of Kitsap PUD, Puget's Pres Frank McLaughlin announces. He alleges that this group is trying to prevent sale of Puget to a PUD group (see related story on page 117).

ASME Annual Meeting—At panel discussion of central station construction costs, A. T. Learned, Ebasco Services, said building structure, substructure and condenser water works represent 28% of total plant investment today. Average unit costs, he pointed out, for reinforced concrete foundations were $32 to $58 per cu yd; for reinforced concrete above ground, $50 to $145 per cu yd; for structural steel, $245 to $340 per ton; for 8-in. brick walls, $1.68 to $4.20 per sq ft; for 12-in. concrete block walls, $1.25 to $2.50, and for sheet steel or sheet asbestos 47¢ to $1.45 . . . Herman Weisberg, Public Service E&G, revealed boiler plant and its building in today's stations represent 50% of total investment. Station manpower has dropped from one man per 500 kw in 1912 to one man per 3,000 kw in 1952. Station volume has dropped from 50 cu ft per kw in 1927 to 12 cu ft per kw in 1952.

From New England—Proposed acquisition by Connecticut L&P of Clinton Electric L&P will mean a 5% decrease in bills of latter's customers, Connecticut L&P's Pres Sherman R. Knapp says . . . New 110-kv transmission line, designed for ultimate operation at 220 kv, is placed in operation from Edgar plant of Boston Edison to West Medway. Feature of the program is a tie-in with other utilities in southeast Massachusetts in Brockton-Plymouth area. Aluminum conductors are used.

From Middle Atlantic Area—Charles N. Cotter, Jamestown, N. Y., realtor, proposes to City Council that Jamestown sell its electric system to finance various civic projects for about the same amount as total electric division assets listed by Board of Public Utilities which is close to $13 million.

From the Far West—Bids will be called immediately for construction of a $52-million, three-dam project to produce 81,000 kw of power on California's Stanislaus River, following approval of $52-million bond issue by South San Joaquin Irrigation District and Oakdale Irrigation District voters. Pacific G&E will get the output . . . California PUC authorizes Plumas-Sierra Rural Electric Cooperative, Surprise Valley Electric Corp, and Anza Electric Corp to operate as public utilities.

Construction—British Columbia Electric puts in operation 82,000-hp Wahleach hydro plant near Vancouver.

Public Relations—PIP's Electricity for Better Living observance, scheduled for 1953, got underway Dec. 12 with the mailing of a kit of information and material aids to participating companies.

Rates—Washington State PSC grants temporary 11% rate hikes to Puget Sound P&L and Pacific P&L during period when they must buy steam power to supplement their hydro . . . First of two hearings on Washington Water Power's $1-million-a-year rate hike was held in Spokane last week before Washington PSC. Second hearing is scheduled before Idaho PSC on Dec. 16.

Regulation—Walter T. Fisher, chairman of Illinois Commerce Commission since 1949, will resign on Jan. 15 . . . Harold A. Scragg, 61, chairman of Pennsylvania PUC died in Scranton on Dec. 7.

Reduced power consumption, due to mandatory and voluntary curtailment as well as to warmer weather, causes Depa officials at Tacoma to announce further cuts in power are unlikely during December in Pacific Northwest. "Situation is no worse and no better than it was a week ago," officials report. "But each week which passes without a worsening of situation brings us closer to end of season and reduces likelihood of increased curtailment." . . . Tacoma City Light proceeds with plans to relay industrial customers off the line as its contribution to help keep Northwest Power Pool intact in case of a severe outage. Relays are set at 75 cycles to dump 80 to 100 Mw of load automatically, with the exception of essential lighting and industrial process load.

Congratulations—Pennsylvania W&P elects David E. Williams, board chairman of Girard Trust Corn Exchange Bank, Phila., chairman of board . . . International GE elects Gerard Swope, Jr, vice president . . . Sangamo Co elects H. Laurence Kunz, vice president.

POWER PROJECT proposed by New York would be built in International Rapids section of St. Lawrence River. Proposed Barnhart Island powerhouse would be at right, Long Sault Dam at left. Canada would build half the installation. Artist's view looks toward Ontario

New York Takes Its St. Lawrence

Power Authority of the State of New York marshalled strong support for its application to build the U. S. portion of the St. Lawrence Power Project as hearings began last week before a Federal Power Commission examiner.

A packed hearing room evidenced the wide interest in the proceeding at which the Authority is seeking a federal license to build and operate a 940,000-kw power project in the U. S. waters of the river. Hydro-Electric Power Commission of Ontario would build the remaining portion of the project, which would have an equal generating capacity.

Backing the New York agency are the Canadian government, the Great Lakes-St. Lawrence Association and several states which would benefit either from the power project or a future navigation project on the river.

Supporting the authority with qualifications are such groups as American Public Power Association, National Rural Electric Cooperative Association and public service commissions of Vermont and Connecticut. The associations want public bodies to be given preference in sale of power and the commissions a guarantee that states other than New York will re-

Story to FPC

ceive some of the power developed at the project.

Hard core of protest to the application comes from coal interests which fear the power project would disrupt coal markets in the area. Also in opposition is the National St. Lawrence Project Conference whose members include railroad interests, East Coast and Gulf port shipping interests, and civic groups.

A recent application by the Public Power and Water Corporation of Trenton, N. J., to build the project with an additional navigation feature is also pending. However, the New York application has priority both in point of time and nature of the applicant.

As hearings began there was no indication as to how long they might continue, but most of the direct testimony could be completed in a week. Since 35 intervenors are taking part, the hearings could last several weeks. An attorney for coal interests moved for a postponement until Feb. 1. Previously the commission had denied a similar request by Central Pennsylvania Coal Producers Association.

From opening presentations at the hearing, it appeared arguments would center around the following contentions.

For the license:

- The New York Power Authority is best qualified to do the job, and its plan is in conformance with comprehensive development of the St. Lawrence.
- The project will contribute to the resource development and defense of both the U. S. and Canada.
- The project opens the way for the navigation project on the Canadian side of the river which will permit ocean shipping to reach the Great Lakes.

Against the license:

- Because of the international nature of the project FPC has no authority to license a portion of it.
- Because of legislative directive, the power authority cannot agree to a recapture clause in a federal license. Such a clause is required in each license issued by FPC.

To qualify the license:

- Some guarantee should be written into the license to assure preference sale of power to designated agencies, and to assure that states other than New York get a share of the power.

Speaking for the FPC staff, Counsel W. W. Gatchell said no recommendation would be made on the application until the conclusion of the hearings. However, FPC's Bureau of Power has already approved the engineering features of the N. Y. plan.

A similar Bureau of Power report was issued in September 1948 at the time of the original hearings on the application of the Power Authority of the State of New York. Following the 1948 hearing, the commission by a 4-1 vote turned down the application on the ground that the power project along with the comprehensive seaway project should be undertaken by the federal government in cooperation with the Canadian government.

When Congress this year declined to authorize federal participation in the seaway project, a federal court of appeals remanded the New York application to FPC for further consideration.

Conclusions . . . Major conclusions of the recent FPC engineering report are:

- The project as proposed by the Power Authority would develop adequately the power resources of the International Rapids section of the St. Lawrence River.
- The project is economically feasible.
- A market exists for the project output as soon as it can be made available.
- Works proposed are compatible with the improvement of the river for navigation.
- Project is best adapted to a comprehensive plan of development of the St. Lawrence River.

Major differences between the recent report and the one issued in 1948 are that cost estimates have been brought up to date and the Iroquois Control Dam, partly in the U. S. and partly in Canada, has been added.

Covers U. S. Portion . . . The N. Y. application covers only that portion of the power project which would be built in the U. S. The Canadian portion of the project is to be built by the Hydro-Electric Power Commission of Ontario.

Total construction cost to be borne by the N. Y. Power Authority is estimated at $260,850,000. Annual costs based on public financing are estimated at either $13.8 million or $14.8 million depending on whether the cost of money is figured at 3% or 3½% annually. On this basis the cost per average year kwhr would be 2.20 mills or 2.36 mills.

By adding transmission costs, financed by private capital, FPC estimated the delivered costs per average year kwhr at load centers, would be either 4.12 mills or 4.29 mills. At the same load centers, FPC estimates the minimum cost of providing the same power from steam generating plants would be 6.98 mills per kwhr.

Clapp Bids GOP Push TVA's Growth

- **Chairman declares the authority will need to add 3,750,000 kw at a cost of $1 billion over the next five years**
- **He warns failure to continue to supply funds for power program will hold back region's economic progress**
- **Growing AEC requirements may prod somewhat reluctant Congress into appropriating money for steam plants**

GORDON CLAPP

Tennessee Valley Authority is the first of the New Deal agencies to disclose its strategy for working under a Republican Administration.

TVA's course: Let the Eisenhower administration compete with the record of the Democrats in supporting the "noble experiment."

Clapp Is Blunt . . . The new policy was outlined bluntly in a recent speech by TVA Board Chairman Gordon Clapp, a Truman appointee whose term expires in 1954. He told a Knoxville, Tenn., Kiwanis Club audience, "We have come this far in this valley because of a dynamic partnership between the people and a federal agency for regional development."

Asked Clapp, "Can we go on?"

Although TVA was originally designed to aid the all-round development of the valley, more than two-thirds of the $1.5 billion thus far appropriated by the federal government has gone for development of electric power. Republicans are being asked to continue or increase this ratio.

Five-Year Program . . . To meet expanding power needs in the valley during the next five years, TVA estimates it will have to add approximately 750,000 kw a year at a cost of $200 million. This is exclusive of the Atomic Energy Commission requirements. The five-year, $1-billion program is approximately equal to the amount appropriated by the Democrats during the past 20 years.

Only alternative to this continued spending, Clapp hinted, is to limit the region's power supply. "If you would hold a region to a lower standard of living, you can do it by placing a limit on its supply of electric power."

TVA and GOP Congress . . . Admittedly this is bold strategy. TVA may be relying on the surprise element to win its first go-round with the Republicans in Congress and in the administration. But apparently it believes this is its only course. In its only previous encounter with a Republican Congress—the 80th—the agency ran into trouble. It was then fighting to break away from its traditional policy of building hydroelectric projects. It wanted Congress to authorize construction of the New Johnsonville steam plant, but the Republicans flatly refused.

After the Democrats won back the Congress in 1943, TVA got the go-ahead on New Johnsonville and a number of other steam plants. To a number of lawmakers, the construction of steam generating plants was a departure from the whole TVA philosophy. The new policy made the agency, in fact, one huge regional electric utility. By 1955, TVA's steam plant capacity will be twice that of its water power generation capacity.

Potent Ammunition . . . But the growing power demands of AEC has furnished TVA with potent ammunition for its yearly appearances for funds. In one slice last year, AEC asked the agency to supply it with 1.6 million kw of capacity. TVA supplied power for the first AEC plant at Oak Ridge and has been its biggest supplier ever since.

To justify expansion during the past few years, TVA has argued that a major part of the power expansion is required for atomic energy installations. Congress has generally gone along with these requests.

Growing Reluctance . . . However, there has been a growing tendency among some Congressional groups to try to trim TVA appropriations. The House this year voted to cut the funds by $28 million, which represented four steam units. The Senate restored funds for two units, and a later supplemental appropriation nullified the House reduction.

Next year TVA is certain to run into renewed opposition to funds for steam plant expansion. Rep George A. Dondero (R. Mich.) who is expected to head the House Committee on Public Works when the GOP takes over said he believes there will be "no further vigorous expansion of steam plant capacity" by TVA.

"In steam plants you have something in which private industry is ready and willing to invest, and private industry should not have to compete with government," he declared.

The Republicans, however, will have a tough time trying to alter the course of TVA expenditures. A large part of the money requested during the coming year will be for continuing construction on steam plants already underway. Cuts in these appropriations would either delay or stop construction in progress. This would mean a loss in an investment already made.

Alternatives . . . Only immediate alternative to TVA construction of steam plants would be to have these plants built by the municipalities or industries among TVA's power customers. One drawback to this method is that the plants would probably be of small, uneconomical types. TVA is now relying on the largest plants to bolster its system. Its

625,000-kw New Johnsonville is among the largest in the world, and energy produced there is only slightly more expensive than that which is produced at plants in its hydroelectric system.

The other alternative would be creation of privately financed generation companies, such as the one which will serve the Ohio Valley AEC plant. These plants could be integrated into the TVA system to bolster and expand present generation. But either of these alternatives would be a greater departure from present TVA policies than was the decision to let the agency construct its own steam generating plants.

Calepco Plans New Unit

California Electric Power Co will build a fourth unit, rated at 40,000 kw, at its new Highgrove steam generating plant, located between Riverside and San Bernardino in southern California. Work will start on the new unit in 1954 with completion scheduled for November, 1955. The first two 30,000-kw units at the plant went on the line several months ago. The third, with a capacity of 40,000 kw, will be completed late next year.

Plant Costs Can Be Held Down

Engineers attending ASME meeting believe this can be done, but only by intensifying present economy techniques

Engineers agreed that the costs of power plants today can be held down in spite of rising costs of materials, equipment, and labor. This can be done by intensifying and extending the same techniques that have kept them from skyrocketing higher than they now are. This was the sense of a symposium at the recent annual meeting of the American Society of Mechanical Engineering under the chairmanship of J. H. Harlow, mechanical engineer of Philadelphia Electric Co. Panel contributions came from civil and mechanical engineers of consulting firms and utilities.

Building Costs Up 520% . . . General construction costs were reported up 520% since 1912, boilers up 720% and boiler plant auxiliaries up 550% in the same time. But Herman Weisberg, Public Service Electric & Gas Co, declared that a 1912 plant design built today would cost just under $400 per kw as compared with $160 per kw for a plant of the latest design. On this basis power plant costs can be considered to have come down sharply rather than to have gone from say $90 to $132 per kw as broad averages.

Moving to the turbine component as his assignment, E. H. Krieg of Stone & Webster Engineering Corp remarked, facetiously, that bid prices for units "seldom varied 50% among them" so he would have to find elements of economy in their application or operation. New standards for turbogenerators, he said, would discard everything but guaranteed capability and so eliminate confusion that has been rife while other rating designations have been in use. In reducing costs, he said, it is important to design the whole plant to realize the full guaranteed capacity and not ignore the 7½% or so of "stretch" available even beyond that rating. Lowering vacuum from 2½ to 1 inch adds 1.6% in output whenever it can be done. Lowering short circuit ratio from 0.9 to

(*Continued on page* 98)

Breaking Ground for Ohio Valley Electric Plant

Early this month Ohio Valley Electric Corp broke ground for two large steam plants which will furnish power for the government's atomic energy plant being built in Pike County, Ohio. At a ceremony at Gallipolis, Ohio, Gov Frank J. Lausche sat at the controls of a 25-ton tractor used in scooping up the first ground for the 1 million-kw plant (left). With the governor is regulator operator on the tractor. Speaker at the ceremony was Philip Sporn, president of American Gas & Electric Co (right). The following day ground was broken for plant at Madison, Ind.

TRANSFORMER NOISE TESTS like this play a key role in the elimination of sound sources from modern power transformers

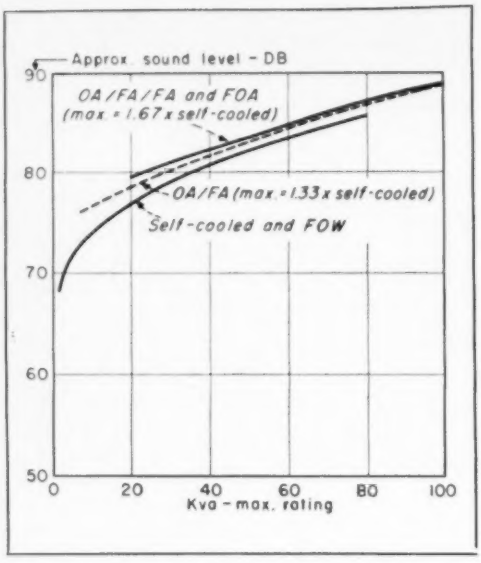


Fig 1—TRANSFORMER NOISE LEVEL is a function of maximum kva but is different for different cooling methods

How The Manufacturers Look at

The Transformer Noise Problem

Across-the-board reduction of NEMA noise levels could only be absorbed by a general increase in over-all investment

T. D. GORDY

W. S. HILL

General Electric Co. Pittsfield, Mass.

The individual "case treatment" approach to transformer noise is the least expensive for electric utilities. Today the transformer art demands more material to secure lower NEMA noise levels. As a result the many installations where noise is not a problem would have to carry the cost of design changes to satisfy a few special installations.

Field Considerations . . . Evaluation of noise is difficult and varies with the individual. Hearing sensations in the human ear depend on component frequencies and their relative intensities, on whether the noise is continuous or intermittent, of pitched or broadband type. Sound level meters cannot evaluate noise in the same way as the human ear; they are a compromise between what is desirable and what is practically attainable.

Sound level meters are limited by their complexity to three scales:

The 'A' or 40-decibel scale which responds to various frequency intensities approximately as the ear responds to a single frequency at 40 db.

The 'B' or 70-db scale which has essentially the single frequency response of the ear at 70 db.

The 'C' scale which registers intensity level at any frequency without weighting.

Transformer sound levels vary from 20-90 db, and many pitched frequencies are emitted. Fan noise adds a broadband spectrum. Commercial sound meters can give only average values and therefore do not completely evaluate nuisance values of transformer noise levels. Improved methods of specifying and evaluating transformer noise are being studied by various national committees, but the solution is still in the future.

Present Standards . . . Transformer noise is now measured at no load, normal-rated frequency, and without tap-changing equipment in operation. Also specified:

1. Except for the ground, no sound reflecting surface closer than 10 ft to the transformer.

2. Ambient sound level 10 or more db lower than the combined transformer and ambient level.

3. 'A' or 40 db weighting network of the sound level meter.

4. Microphone positions at definite heights and spacings to the transformer contour.

5. Transformer sound level taken as the arithmetic average of all the microphone position readings.

It is difficult if not impossible to attain such test conditions at most installations. Manufacturers even have difficulty getting adequate test conditions for large transformers. A realistic evaluation of test conditions must be made to get approximate results satisfactory for most work.

Noise and Distance . . . The change in noise with distance from the trans-

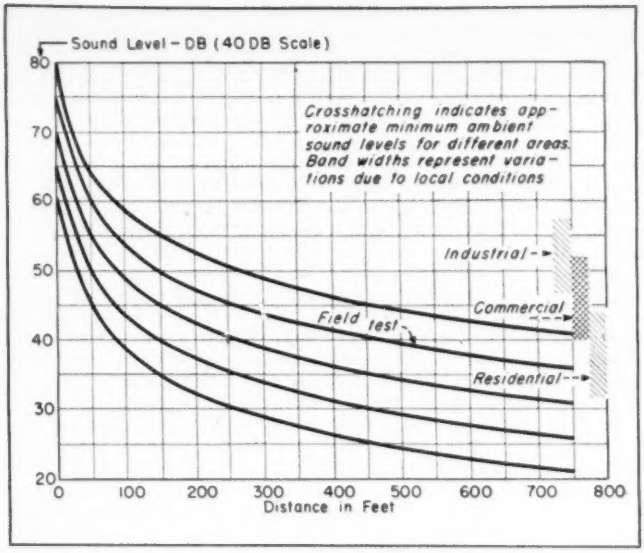


Fig 2—NOISE ATTENUATION with distance, based on a single unit field test. Minimum noise ambients shown crosshatched are typical for various types of areas

former depends on rating, size, and shape of the transformer. At different points a transformer may appear as a plane, cylindrical, or point source of noise, or as a combination of these. As the distance from the transformer is doubled, the sound level decreases 0 db for a plane, 3 db for a cylindrical, and 6 db for a point source.

Other factors in the attenuation of noise with distance are height of observer, ground contour, geometry of the source, atmospheric conditions, reflecting and absorbing surfaces, and ambient sound levels. A mathematical analysis of all these factors is difficult, but many such effects can be included in a model test. A model may be the only way to include buildings, ground contour geometry, and proximity effects. Models generally yield not absolute but reasonably accurate relative results.

Model Testing . . . The scale of the model will depend on the area studied. To maintain the proper ratio between sound wave length and linear length of the area, the power frequency must be increased by the scale ratio of the linear dimensions.

With a model, each major frequency component of the transformer noise can be studied and sound level patterns obtained throughout the area. As many sound sources can be located in the model area as are in the actual installation. Suppression or reinforcement between sources can be detected; height of enclosing walls, effect of absorptive material, sound pattern variation with height, enclosure shape, and many other factors which could not be economically and accurately included in an analytic survey can be studied in the model test.

Results of model tests to date check very closely with field results. Successful methods were found for eliminating standing wave patterns and measuring average sound levels. If a user has a complex noise problem, a relatively inexpensive and short-time series of model tests give worthwhile data on the effects of noise suppression methods.

Basic Variables . . . Fig 1 shows the effect of kva-size on sound levels. In general, doubling the kva-size increases the sound level by about 3 db; that is, the sound energy is doubled. Also, one three-phase unit will have a lower noise level than two three-phase units of the same total capacity. The physical location of the different units affects interference patterns and a multiplicity of units increases the noise level up to 200-300 ft. Beyond this distance tests may show little difference between one and three units of equivalent bank size. Fig 1 also shows that self and water-cooled transformers have the lowest noise level for a given rating. Very little difference can be found between the OA/FA and either the OA/FA/FA or FOA designs using noise level at maximum kva as the criterion rather than equivalent size. Fans add about 1.0 db at equivalent maximum kva rating. Dry-type units have higher noise levels than liquid-filled units.

Noise level varies directly with flux density and therefore with applied voltage; so operating above rated voltage as a means of maintaining required output voltage at load will increase the noise.

Attenuation factor, the db decrease as the distance is doubled, is not a constant. For a single source it may range from 4-5 db for distances up to 80-100 ft, increase to 6 db beyond this. For multiple units, attenuation factors are 1-2 db lower; that is, more distance is needed to reach the same minimum sound level. Fig 2 shows field test curve of a single unit and plots of varied initial sound levels for the same unit.

Controllable Characteristics . . . Every utility has the problem of finding suitable sites for substations. Although one location may meet all the requirements of economic electrical distribution, compatibility with surroundings may force evaluation of seemingly less desirable locations. Substations built for future expansion may be faced with obstacles arising from new buildings. Study of neighborhood compatibility may yield long-term dividends.

Ambient sound level is generally highest in industrial, lower in commercial, lowest in residential areas. Non-residential areas should be favored if possible. Between industrial and residential areas, the minimum ambient sound levels may differ 15 db, the maximum 20-30 db. A highway with day and night traffic or a woods or pond with wild-life noise may increase the ambient noise in a residential area.

Minimum sound levels depend on surroundings. Fig 2 shows broad bands of minimum ambient levels expected from different types of areas and the spacing necessary to reduce noise to near ambient levels. Transformers may be audible beyond these minimum level distances, but an audible noise level does not always mean an objectionable noise level.

For indoor locations, fireproof walls will usually be effective in isolating air-borne transformer noise, providing air ducts are kept out of the transformer vaults. Structure-borne noise is vibration, treated by absorbing pads, proper mounting, and locations.

Available Solutions . . . Designing transformers for low sound level is as much of a design problem as designing them for any other characteristic. Designing for low noise is made difficult by variations in structure and processing that are not as readily controlled as similar operations that determine copper loss, insulation strength, impedance, and temperature rise.

Transmission of vibration and sound from the various sources to final emission from the transformer to air is through a complex electro-mechanical, acoustical circuit. The simplified block diagram of Fig 3 shows interconnections of sources and transmission paths. Sources are shown in heavy blocks and direction of transmission between components is shown by arrow heads.

Structurally the transformer, as a unit, must be capable of withstanding short-circuit forces, lifting forces, and shipping impacts. The transformer must be so built that it will have a long life free from breakdown and other troubles which require expensive maintenance. As a design, the transformer must be efficient electrically, mechanically, and thermally, as well as an economic one. It must meet core loss requirements, impedance guarantees, and size and weight specifications. The problem of designing to meet a certain noise level must be solved simultaneously with meeting all of the above requirements.

Operating flux density of the core may be reduced with a resulting reduction in sound level. As flux density is lowered, the cross-sectional area of the core increases as does the mean length of turn of copper and the weight of solid and liquid insulation. Thus the overall size of the transformer enlarges. Flux density may be reduced to a certain point, and a corresponding noise level reduction may be obtained. If the flux density is reduced beyond this particular point, core weight increases faster than noise level decreases, and no net decrease in transformer sound level is obtained. This minimum flux density point is well below normal working flux density in most transformers, but it is a point below which flux density cannot be reduced in order to obtain reduced sound level.

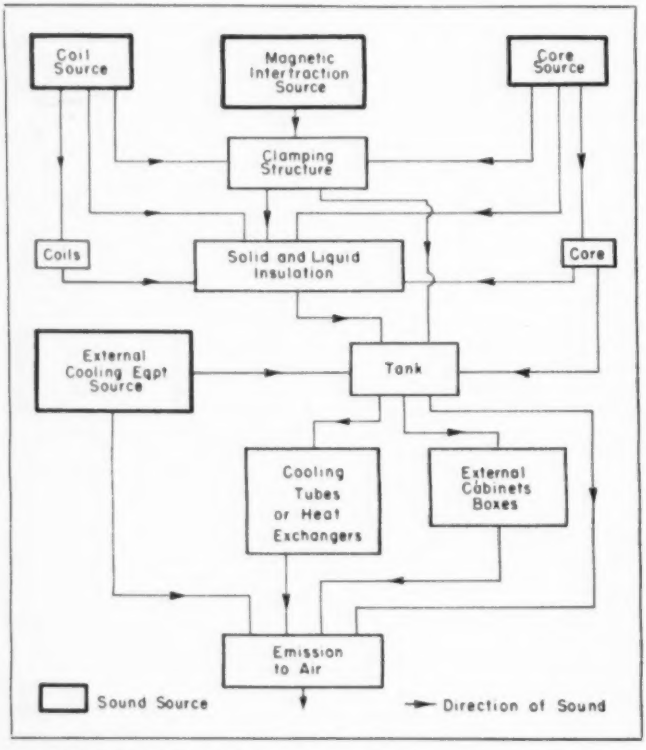


Fig 3—ACOUSTICAL CIRCUIT followed by sound from sources (shown heavily boxed) to air is a complex electro-mechanical path. Designing for low noise level is complicated by intricacies of circuit interconnections shown.

As noise level is a function of a state of flux in the core, the type of core and joint affects the noise level emitted by a transformer. Not only is noise dependent upon the magnitude of the flux in the core, but it is dependent upon the wave shape of the flux. Harmonics in the flux wave introduce harmonics in the forces at the gaps and joints, and these forces then introduce vibration harmonics. Vibrations result in emitted noise and therefore yield harmonic components in the emitted sound from the transformer. The way in which joints are built into the core can have a great effect on the amount of noise reduction that is obtained. When joints do not appreciably affect flux distribution in the core, the flux path in the core will be such that a minimum noise level will be obtained.

The core must be supported and clamped to withstand the mechanical forces that may load it. If clamping is such that the core steel is seriously strained, the main flux of the core will be distorted. This distortion will result in a sound level increase. To maintain low noise level, it is necessary that the mechanical, as well as the magnetic, design of the core receive adequate attention.

There are two principal paths through which sound and vibration may be transmitted from the core and coil structure to the tank. One path is a mechanical one through the bottom of the core and coil structure to the tank, thus driving the tank from the bottom. The other path is from the core and coil structure through the liquid insulation between the core and coil structure and the tank. This path allows the tank to be driven over its entire wetted area. In some sizes of transformers, resilient mounts may be installed between the core and coil structure and the bottom of the tank to minimize the noise and vibration transmitted through the mechanical

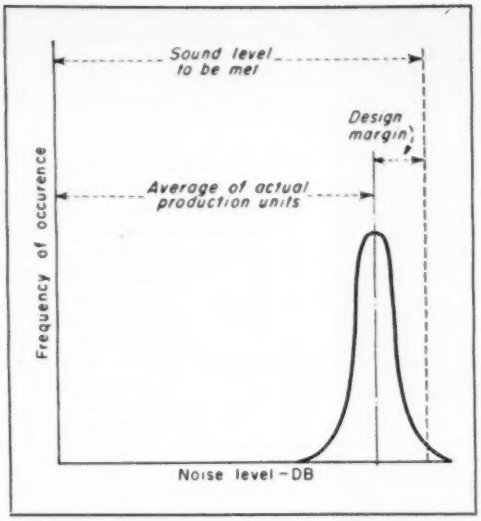


Fig 4—TYPICAL STATISTICAL PATTERN of noise level vs frequency of occurrence for a number of similarly rated transformers

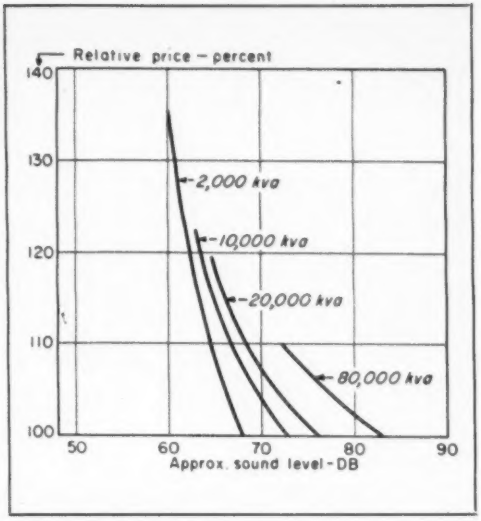


Fig 5—LOWER FLUX DENSITY means less noise, but it also requires more iron, larger cores, greater weight and means higher cost

path. The efficiency of these mounts varies with the size and design of the transformer, and their efficiency as a noise suppressor may vary from zero to 5 db.

Internal sound barriers may be installed in the transformer between the core and coil structure and the tank to reduce the amount of sound that is transferred through the liquid insulation. Again, the efficiency of these barriers is dependent on the size and design of the power transformer. Still another type of barrier may be used external to the transformer tank. This barrier will be exposed to the atmosphere and must, therefore, be weather resistant. The efficiency of such a barrier is dependent upon the treatment that it receives as a sound suppressor and the type of mounting that ties it to the transformer structure.

When applying barriers and mounts inside the transformer, it is necessary that heating, insulation, and life requirements be considered. These requirements place a serious handicap on materials and constructions that may be used for such sound isolation measures.

NEMA Noise Levels . . . Measurements made on many types of transformers manufactured over a wide period of time have shown substantial variations in noise level for equivalent kva ratings. The industry is inclined to conclude from such data that the lowest levels observed can be readily duplicated at will. Just how realistic this is should be a matter of careful consideration.

Investigation of units having low noise levels may show that the particular transformer is made with a special steel or operates at abnormally low densities, or both. The use of grain-oriented, cold-rolled steel at higher design densities has been advanced to reduce physical size and weight.

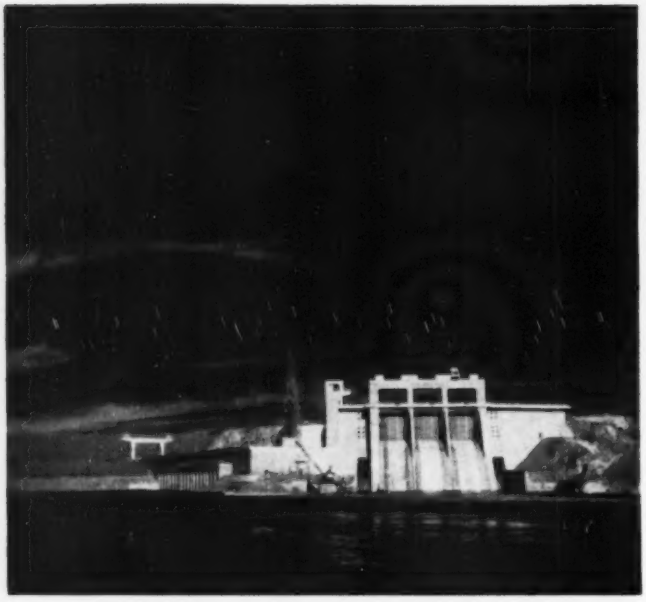
The electrical manufacturer meets electrical guarantees very closely, but he does not yet have a similar close control of noise comparable to those over other characteristics. To meet a given noise level, he must therefore base his design on noise levels lower than industry levels.

Fig 4 shows a typical statistical pattern of the noise level versus frequency of occurrence for a number of similarly rated transformers. This type of curve, familiar in quality control work, illustrates why individual units tested in the field sometimes show considerable variation in noise levels and often are below industry levels.

Because of the spread in noise-level pattern indicated by Fig 4, a designing engineer must base his design on the average of the pattern using whatever factors and methods he has at his disposal. In this process he may find severe restrictions caused by the necessity of maintaining guaranteed electrical losses and dimensional limitations. Single units given noise tests may show values anywhere along the curve of the shape shown by Fig 4. In order to protect against exceeding the predetermined level, the manufacturer often builds a unit which tests substantially lower than the maximum allowed.

This has sometimes led users to the erroneous conclusion that guaranteed limits can be met readily and that NEMA levels are, therefore, too high. Until the manufacturers can control noise level to a narrower "range," in the statistical sense, than at present, they will continue to be exposed to this criticism. The frequency curve of statistical control represents the best explanation of the problem faced by the transformer manufacturer.

After taking advantage of core arrangements, joint configuration, selection and treatment of core steel, resilient mounting, and other available factors, further decrease in sound level which may be required is normally secured by reducing flux density. This means more iron, therefore increased dimensions resulting from larger cores, greater weight, and higher cost. Generally the higher cost factor is of greatest concern to the user. Although relations between increased costs, noise level reduction, and kva are complex, Fig 5 shows the general inter-relationship between these factors.



Davis Dam Is Dedicated

Governors of 12 states and of Alaska and Hawaii joined with Bureau of Reclamation officials on Dec. 10 to dedicate the $119-million Davis Dam, newest Reclamation development on the Colorado River. Massive concrete spillway and intake structures of the dam are shown at right.

Under Secretary of Interior Vernon D. Northrop gave the dedicatory address and each of the governors spoke briefly.

Honored at the ceremony was Mrs Arthur Power Davis, widow of the pioneer Reclamation engineer and administrator for whom the project was named. Davis, Reclamation director from 1914 to 1923, authored the Colorado River development which has resulted in seven dams on the Lower Colorado.

Davis Dam with an installed hydroelectric capacity of 225,000 kw from five 45,000-kw generators, was designed as a regulating structure for Hoover Dam, 67 miles upstream. Davis will permit the sharp fluctuation of water discharges from Hoover Dam, allowing a discharge through Hoover generators to their maximum capacity of more than 1.2 million kw at peak periods, and a sharp curtailment of its flow in off-peak hours.

Power Plant Costs

(*Continued from page* 93)

0.5 saves 25% in kva and 10% in losses.

Economy Measures . . . As to steam pressure Krieg asked: Why pick 1,250 psi when a 1,450 psi unit costs no more per kw? On a 100 Mw unit why not specify 0.85 pf rather than 0.80 and save $40,000? As for installation, much money can be saved by scheduling arrival of equipment so that the second unit can be put in place immediately after and not overlapping with the first.

H. A. Wagner, Detroit Edison Co, pointed out that steam cycles offer opportunities for economy in two principal directions: one in cycle values, the other in arrangement of components. Beyond the gains already achieved by higher temperatures and pressures lie those available in the direction of double or triple reheat, and in the application of liquid metals in the reheat part of the cycle.

Coal Handling Costs . . . Coal handling offers little gain in dollars per kw as plant sizes increase, said R. W. Parkinson, Commonwealth Associates. Nor can much be saved by partial installation for initial units and completion as the plant expands. He cited costs ranging from $4 per kw for a two-unit 170 Mw plant to $18 for a comprehensive installation for a single unit 40 Mw plant.

Inordinate rise in costs of conventional steel-frame, brick-wall construction has forced a shift to other forms of power plant building construction. A. T. Larned, Ebasco Services, pointed out that the civil engineer is responsible for up to 28% of the total outlay for the plant and this component can be sharply reduced by resorting to outdoor or semi-outdoor design. He called the introduction of prefabricated wall panels a major milestone in building construction and said they show promise of much wider application.

Oil-Ash Deposits . . . Problems springing from oil-ash deposits on gas turbine blades and boiler tubes drew sharp attention at several ASME sessions.

General Electric Co's B. O. Buckland, C. M. Gardner and D. G. Sanders are seeking to reduce gas turbine blade corrosion by using corrosion resistant alloy blading and additives to modify the residual oil fuel. According to these experimenters modified oils and chrome iron hold the biggest promise . . . at present.

Philip Draper, Shell Petroleum Ltd, London, is trying to prevent the corrosive ash deposits from forming on the gas turbine blades. He has found that coarse oil atomization (70 microns surface diameter) at the cost of 1% combustion efficiency produces spherical hard-carbon particles that trap ash and carry it out of the turbine, keeping blades clean and free of ash.

Hard glassy boiler-tube deposits, traceable to sulphur, sodium and vanadium in fuel oil ash, have been rendered soft, powdery and easily removable by adding Dolomite to fuel oil. Experiments at Inglis Station of Florida Power Corp. were reported by J. B. McIlroy and E. J. Holler of Babcock & Wilcox Co with R. B. Lee of Florida Power. These showed that adding one part Dolomite to one part ash in the oil cut the cost of boiler cleaning from 7.3 to 0.78¢ per barrel of fuel oil burned. It also lowered the dew point of flue gas by 100 F, reducing its corrosive effects and lowering the maintenance required on air preheaters.

UWU: Will Its Attitude Shift?

That, says Pres Joe Fisher, depends on the approach to public power taken by the new Republican Administration

For the fourth consecutive year the Utility Workers Union of America has opposed a resolution favoring federal hydroelectric development adopted at the annual convention of the Congress of Industrial Organizations.

But this year, at the CIO's 14th convention in Atlantic City, UWU Pres Joseph A. Fisher indicated his union might very well change its approach to federal development, depending on the Eisenhower Administration's attitude toward the problem.

Up to now, the Utility Workers' stand has been that the federal government should not build distribution facilities from hydro projects where private companies are ready and willing to do the work.

The union has also opposed the preference clause.

But, said Fisher, "We certainly can't go all out with the utility industry that there should be no federal development.

"Sometimes I think that instead of opposing government acquisition of power facilities we may find ourselves favoring more government development than we'll be getting, the way things look now."

A Question . . . The utility union president said it was too early to determine exactly whether his organization's present policy would have to be changed.

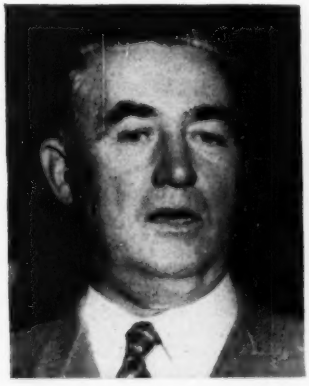
"We don't know at this time," he said, "what the policies of the new Republican administration will be in regard to public power. But by the time of our own convention in Detroit next April, we may have a sufficient idea for us to formulate a revised policy of some sort."

At last year's CIO convention, the late Philip Murray appointed a committee to work with the UWU in drawing up this year's resolution concerning regional development and conservation. The committee met and tried to reach a compromise between the views of the UWU and its parent organization. It succeeded to some extent, but Fisher rose on the convention floor and announced he was opposed to portions of the resolution on hydroelectric power in conflict with his union's policies.

UWU's JOSEPH FISHER

The UWU, for instance, has opposed TVA-like basin authorities, partly because the membership feels "the most favorable conditions of employment for workers in the industry can be secured through collective bargaining in an investor-owned company." The quote is from a resolution passed last year by UWU.

The CIO, on the other hand, since 1944 repeatedly has adopted a statement endorsing the principles of TVA. This year's resolution, while calling for fair employment practices at federal projects, again backed the basin-area development concept. It did, however, urge that hydro portions of basin developments be made to pay their own way.



New Faces in Nation's Top Labor Posts

Martin Durkin, left, 58, a registered Democrat who voted for Gov Adlai E. Stevenson and urged the members of his union, United Association of Plumbers and Steamfitters, to do the same, becomes Secretary of Labor in President-elect Eisenhower's cabinet . . . **Walter P. Reuther,** center, 45, dynamic president of the United Automobile Workers, assumes presidency of Congress of Industrial Organizations. He is expected to make CIO even more social-minded and political than it had been under the late Philip Murray . . . **Charles C. Killingsworth,** right, 35-year-old economics professor from Michigan State College, advances from vice chairman to chairman of Wage Stabilization Board. He joined the board Oct. 1 as public member and vice chairman.

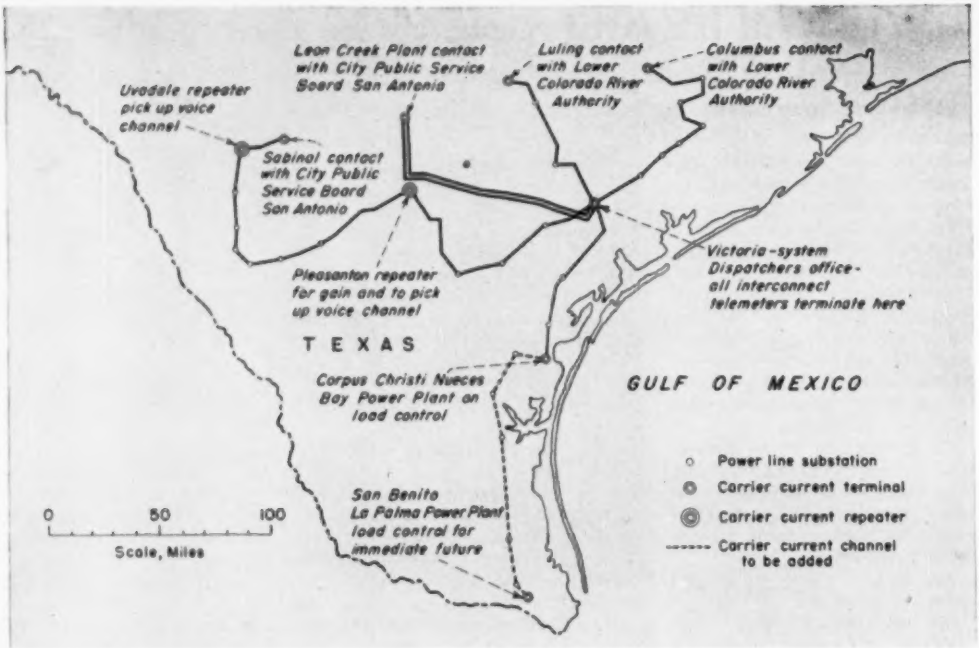

Leon Creek Plant contact with City Public Service Board San Antonio
Luling contact with Lower Colorado River Authority
Columbus contact with Lower Colorado River Authority
Uvalde repeater pick up voice channel
Sabinal contact with City Public Service Board San Antonio
Victoria-system Dispatchers office-all interconnect telemeters terminate here
Pleasanton repeater for gain and to pick up voice channel
TEXAS
GULF OF MEXICO
Corpus Christi Nueces Bay Power Plant on load control
San Benito La Palma Power Plant load control for immediate future
0
50
100
Scale, Miles
Power line substation
Carrier current terminal
Carrier current repeater
Carrier current channel to be added

Fig. 1—POWER LINE CARRIER CHANNELS for telemetering and load control show transmission system which presented complications with one path consisting of 291 miles of 69-kv line with 14 substations and six side circuits

Fast-growing Texas system finds

Telemetering Solves Tie Line Problems

Combination of net system interchange with a summation of total plant generation provides dispatchers with an accurate picture of system operation conditions

PAUL TAYLOR, Communications Engineer, Central Power & Light Co, Corpus Christi, Texas

Until recently the layout of the transmission system of the Central Power & Light Co, and its interconnections, was such that practically all interchange between systems showed up on a single interconnection.

In one of the two other active interconnections, power flow was almost entirely dependent upon generation on the Central Power system in the area. In another, power flow was controlled by a phase angle transformer.

For a number of years very satisfactory operation was obtained by using the interchange in the one sensitive contact to operate, by telemeter, a load control equipment in the largest power plant on the system. Block-loading was used at the other power plants.

However, rapid growth of the system, both in size and complexity, made this type of operation unsatisfactory.

A survey of existing and probable future requirements indicated that there was a need for telemetering the interchange from all operating interconnections to the system dispatcher's office where various summations would be made mechanically and electrically and the final summation used for load control. The details of how this was carried out are discussed here.

The survey showed several other things. Among others it revealed the need to display each interconnection individually as well as provide the summations already required and those that would be needed in the future. Summation information would be needed since two and probably three interconnecting systems, other than Central Power, would be involved. Moreover multiple contacts with the interconnecting systems either exist or are planned. Power line carrier current equipment was selected as the medium for transmitting telemetering intelligence.

Experience with narrow band frequency-shift equipment over a period of years had been very satisfactory. However one serious drawback to this type of transmission developed. One of the paths was 291 mi of 69-kv line with 14 substations and six side circuits(Fig 1). It was evident that a repeater would be necessary since noise levels at the receiving end often reached a level of 50 to 100 mv.

By far the greatest percentage of

trouble on relay keying of transmitters in the past had been occasioned by that of mechanical relays. Therefore, it was considered very desirable to eliminate all mechanical actions possible, regardless of their place in the circuit.

Select Frequency Sensitive System . . . As a result, other equipment for providing this telemetering path was considered, and a new type of power line carrier current equipment selected which provides two telemeters in each direction as well as two frequency duplex voice operation.

The equipment was practically all electronic. Signals can be repeated at will both for the purpose of overcoming attenuation and for convenience in dropping out or picking up side circuits, both voice and telemetering.

The system as installed on the long path in question consists of:

1. The telemeter transmitting station at Sabinal.

2. The repeater station at Uvalde for dropping and picking up a voice channel at the system operator's office.

3. The repeater station at Pleasanton near half way point for overcoming attenuation.

4. The receiver terminal at the system dispatcher's office at Victoria. A two way voice channel is used at all stations and is arranged for magneto-type telephone line extensions.

Has Accuracy and Stability . . . The telemeter transmitting instrument is similar to an ordinary three-phase watthour meter. Two of the three elements are conventional watthour meter elements. They are used for metering in the usual manner based on the familiar "two and a half element" metering principle and connected conventionally into the current and potential transformer secondaries.

The third element is also a familiar watthour meter element with some modification. Its disc has a shaped edge which turns between a light source and a photo-electric cell to produce a low frequency sine wave in the output circuit of an associated vacuum tube. Current and potential windings of this element are connected to a constant voltage transformer and calibrated resistors to produce a steady and fixed torque in the element.

This third element is necessary to produce a positive indication of zero power registration and is adjusted to set the zero power reference line to left margin, center, or some other chart position which may be arbitrarily chosen. In the case of the zero center meter this element is adjusted to produce a frequency midway between the upper and lower limit frequencies; eg, 6 cycles for the power limit, 16½ cycles for zero indication, 27 for the upper limit.

As this is a polyphase watthour meter, it is calibrated and adjusted with conventional meter testing equipment. It has the same degree of accuracy and stability that is exhibited by watthour meters.

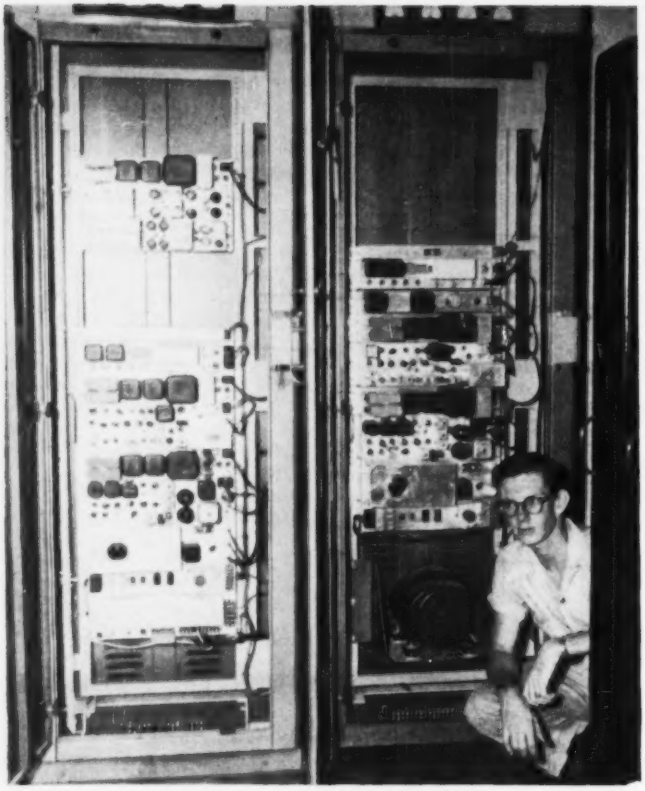
For facility in transmission, these low frequencies are amplified and used to modulate a subcarrier transmitter whose frequency is above that used for voice transmission. The modulated subcarrier is in turn used to modulate the power line carrier transmitter. All modulation of both the subcarrier and the main carrier is by frequency modulation with one-to-one deviation. Voice modulation is applied to the main carrier transmitter after amplification and limiting through the common modulator, with the sub-carrier.

Output of the powerline carrier transmitter is applied to the power line through an aperiodic coupling unit. This is actually a high pass filter that passes all frequencies in the carrier current spectrum with very low and uniform loss. It is capable of matching the transmission line over a wide range of characteristic impedances.

Permits Closer Channels . . . At all stations the carrier current signal is selected by a very sharp, straight-sided filter and amplified and demodulated by more or less conventional frequency modulation receiver processes. The sharp filter is really the heart of the receiver and permits the placing of carrier current channels in the same station or the same area much closer together than is possible without this filtering.

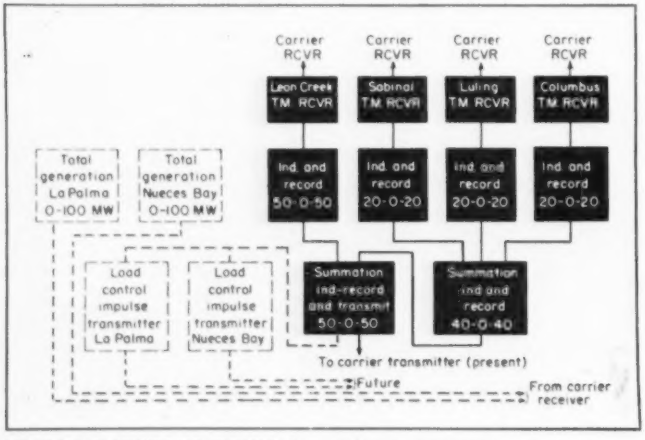
Output of the demodulator contains all of the voice frequencies as well as the modulated telemeter subcarriers. Voice channel frequencies are separated by a low pass filter and passed along to a telephone circuit through a

TYPICAL CUBICLE, shown with Victoria assistant chief dispatcher M. C. Barr, provides for future system growth



CARRIER telephone equipment was recently installed at Uvalde, Tex. Communication serviceman is James D. Dunn

conventional hybrid arrangement. Subcarriers are selected by very sharp band pass filters similar in characteristics to that used in the front end of the receiver. They are passed through amplifiers and limiters and used to modulate the power line carrier transmitter for the next leg of the path.



STANDARD SWITCHBOARD CUBICLE shows equipment arrangement

The voice comes from the telephone line through a hybrid arrangement, is amplified and limited, and appears at the common modulator of the transmitter along with the repeated subcarriers. This process is again carried through at the second repeater station.

At the terminal station the receiving process is repeated except that here the subcarrier is in turn demodulated to produce the original 6 to 27 cycles which is applied to the input of a telemeter receiver. This receiver, by electronic processes, converts the sine wave to square waves. These are rectified to produce a direct current output whose average value is a measure of the frequency of the input signal and is independent of its amplitude and wave shape. This direct current output is then applied to wide chart indicating-recording meters equipped with retransmitting slide wires.

Telemeter channels from Leon Creek to Victoria and from Columbus to Victoria are identical with that from Sabinal to Victoria except that no repeaters are necessary. The telemeter channel from Luling to Victoria utilize the old frequency shift carrier with the new frequency type telemeter instrumentation. The only change in the carrier equipment necessary to convert to this new type instrumentation was to change the receiver relay to one capable of the higher speed operation.

Provides for Growth . . . There is one indicating-recording meter for each interconnection. Summations are made by combining all of the 69-kv contacts into one summation which is then summed with the 138-kv contact to provide the final summation or system net interchange as the system now stands. Provisions have been made for including additional 138-kv contacts and a separate 138-kv summation as growth demands. The final summation will then be the combination of the 69-kv and 138-kv summations. If future needs require, it will be possible to make individual summations for each interconnecting system's contribution. These can then be retransmitted if required.

Future plans call for all new power plant installations to be provided with load control equipment which will be operated by load control impulses from the system dispatcher's office at Victoria and for the telemetering of plant total generation from all major plants to the system dispatcher's office.

PUBLIC RELATIONS & ADVERTISING

An Opportunity

Incoming Administration gives utilities a chance to prove themselves, PUAA group hears

Both P. L. Smith, head of National Association of Electric Companies, and Bayard L. England, head of Edison Electric Institute, feel the industry has a "beautiful opportunity" to advance the interests of private power under the incoming Republican Administration.

They expressed this belief recently in Atlantic City at a meeting of Region 2, Public Utilities Advertising Association.

But, they indicated, success of the private program depends on convincing the people that the free enterprise system in the utility business will make for a better country.

"Fortunately," Smith said, "because of the new Administration, we have people in the government whom we can go to and talk to—friendships that have been built up over the last 20 years."

Preparing Bills . . . Already, he said, NAEC has had requests from Congressmen to draw up certain bills relating to power. He said there was a possibility that the National Association of Railroad and Utilities Commissioners this year would introduce a bill to outlaw the federal preference clause.

"If a non-partisan group rather than the industry introduces the bill," he said, "and it gets good support, we stand a good chance of having it passed. But you can't get all the improvements at once—it would be a mistake to push them all at once."

England, who is also president of Atlantic City Electric Co, expressed the same idea although in a different way:

"You can't expect to turn the clock back on TVA, Bonneville, and Grand Coulee right away. We're going to have a tough time ahead. We must demonstrate clearly and forcefully the advantages of the free enterprise system, first."

Industry leadership, England commented, must realize that big government is here to stay and learn effectively to control it.

Dual Fight? . . . PUAA Pres Paul Penfield, Detroit Edison Co, said he wondered whether the industry was going to have to fight the Republican as well as the Democratic Party on public power.

He pointed out that after President Truman's Hungry Horse speech giving credit to the Democrats for the country's large hydroelectric projects (EW, Oct. 13, p 7), Senator Taft said in effect:

"We Republicans started reclamation, long before the New Deal."

PUAA, Penfield said, must get its ideas against federal development to President-elect Eisenhower through its Congressmen and through advertising. And meanwhile the industry, he added, must ask itself this question:

"Are we ready to pick up the ball if we ask the government to drop public power?"

LeRoy MacLeod, advertising manager of New York State Electric & Gas Corp, was elected Region 2 chairman for the coming year, succeeding W. S. Myers of Atlantic City Electric.

This Planned Work Area for street safety . . . Gets OK of New York Cab Drivers

Over 600 New York City taxi drivers have placed their approval on Consolidated Edison's Planned Work Area program (EW, March 6, 1950, p 16). In filling out a questionnaire prepared by the utility's safety bureau, the drivers who know New York's streets best showed their awareness of problems of street safety and gave the program a vote of confidence.

The company program is intended to reduce and standardize work site areas, give adequate warning of work in progress, and do the job as quickly as possible in order to protect drivers, pedestrians, and company employees.

Greatest disagreement among the drivers was that over the color of the flashing lights used to warn drivers. Red was favored by a majority of the taximen, but amber (the color now used) was approved by nearly 40%. Nearly two thirds favored the high level lights now in use, but 28% favored low level lights, and a few favored flags. Some of the drivers indicated that the present flashers are too bright. The company's safety men had noted this previously, and new lights were on order when the survey was made.

CABLE LAYING halts as 6000-ton liner passes through main channel. The harbor patrol boat stood by in channel to slow down passing ships as cable laying proceeded. Barge and tugs followed specially-prepared channel by constant observation of targets.

Submarine Cables Link Florida Keys

How Florida Power & Light Co engineers solved variety of problems encountered in planning, designing and construction of three 2500-ft, 13-kv submarine cables and a 2700-ft, 13-kv aerial cable bridge crossing.

R. P. BALIN*, Engineer, Underground Section, Florida Power & Light Co, Miami, Fla.

The semi-tropical islands in the Florida Keys are now provided with the same dependable electric service available on the mainland. Situated in an area noted for its phenomenal load growth, Fisher's Island, Virginia Key, and Biscayne Key are no exception. A long-range forecast made in 1950 predicted a tenfold load increase in five years. And with present loads plotting right along the growth curve, additional distribution facilities became necessary.

Long Range Planning . . . Before they were opened to the public by the completion of the Rickenbacker Causeway in 1947, Virginia Key and Biscayne Key were just two green patches on the seascape. To determine the potential demand of their barren, sandy beaches, and draw a predicted growth curve for engineering studies, Industrial Representative C. K. Lingo

1. Estimated the available acreage in the various building zones.

2. Assumed these islands would build up even faster to the same kw per acre load density of a comparable area on Miami Beach.

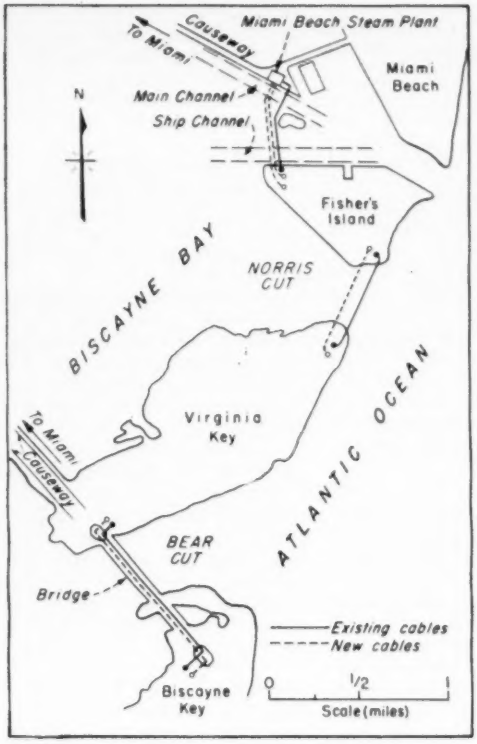
3. Made allowances for air-conditioning, which alone could triple the load.

4. Checked his figures with a direct estimate of the ultimate load based on the opinions of experts in the real estate and building trades and on statements from the planning boards of the city and county.

Engineering Plans . . . With present loads plotting along the growth curve, additional distribution facilities and an increase in primary voltage became necessary. The work to be done by the Underground Department included:

1. Installation of two 2500-ft, 13-kv submarine cables between the Miami Beach steam plant and Fisher's Island

* R. P. Balin is now employed by Ra-Tone Electronics Co, Phoenix, Ariz.



ROUTE of new and existing cables connecting Miami Beach Steam Plant with Fisher's Island, Virginia Key and Biscayne Key.

PULLING CABLES through seawall entrance before start of cable-laying. Pair of targets mark run of 500 ft. Stakes mark turn to left.

CABLE-LAYING underway. Mound of fill to left of center is sand excavated from channel. Spoil bank marks route of cable trench.

to replace an existing 4-kv cable.

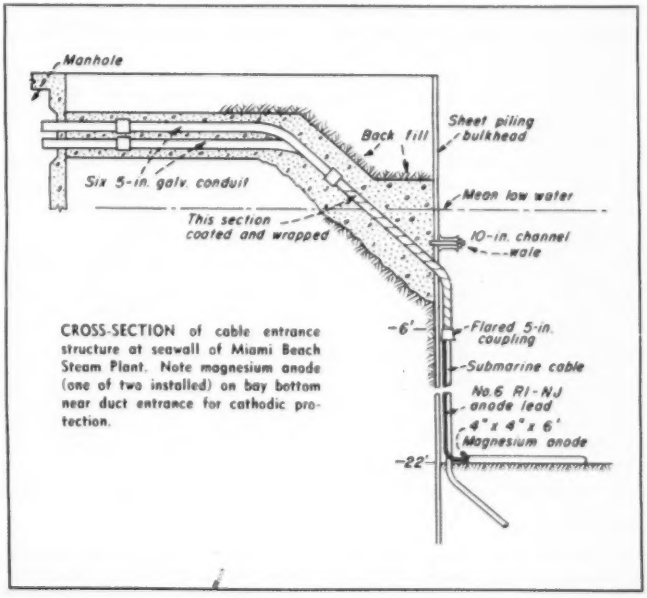
2. Installation of an additional 2500-ft, 13-kv submarine cable in Norris Cut to double the capacity of this crossing.

3. Installation of an additional 2,700-ft, 13-kv aerial cable circuit beneath the Bear Cut bridge to double the capacity at this location.

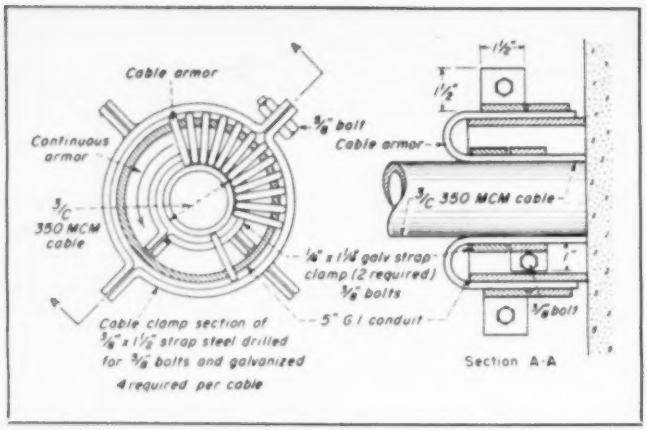
Each of these projects presented its own peculiar problems.

Trench Preparation . . . Between the steam plant and Fisher's Island two active ship channels, on either side of wide mudflats, link the ocean with the bay. Although the channel alongside the plant is 32 ft deep, oil tankers passing thru here often draw 29 ft of water. With ships' anchors always a possible menace, the only way to get adequate protection for our cables was to bury them beneath the channel floor.

But digging a trench in water this deep seemed at first to be out of the question. Old-timers in the area said



CROSS-SECTION of cable entrance structure at seawall of Miami Beach Steam Plant. Note magnesium anode (one of two installed) on bay bottom near duct entrance for cathodic protection.


Cable armor
Continuous armor
3/C 350 MCM cable
3/8" bolt
Cable armor
3/C 350 MCM cable
1/4" x 1 1/4 galv strap clamp (2 required) 3/8" bolts
5" G.I. conduit
Cable clamp section of 3/8" x 1 1/2" strap steel drilled for 3/8" bolts and galvanized 4 required per cable
Section A-A

CABLE CLAMP details showing method used to terminate armor and support cable where 5-in. conduits enter manhole beyond seawall entrance.

the channel's flint-rock bottom would need punching all the way. The 5-knot current and steady stream of fishing boats would hold our progress to a snail's pace. When core borings showed a rocky sand in the channel that could be dug easily enough to make our project economically feasible, we decided to go ahead.

A local contractor, the Ebsary Foundation Co, undertook the task of providing us with:

1. A 5-ft deep trench under the 300-ft wide main channel.

2. A 30-ft wide channel (to provide floatage for the cable-laying barge) with a 3-ft deep trench thru the center of it across the 1,500-ft mud-flats.

3. A 5-ft deep trench beneath the 300-ft wide Fisher's Island channel where the average depth is 16 ft.

After soundings were taken, and the trench plan and profile drawn, tide gages were installed, and targets set up to mark the route.

A barge-mounted crane with a 50-ft boom and a heavy-duty clam bucket were used for trenching. The width of the trench was the width of the bucket, or about 4 ft. In deep water, four anchors attached by cables to hand-winches kept the barge on course. In the flats, spuds were used. Sand removed from the channel was loaded on a material barge and towed to the nearby mud-flats.

A 4000-lb, chisel-point punch had to be prepared and used in guides to break thru a rock formation. The barges were moved by a 35-ft diesel tug, which often had to pull them out of the way of ships passing thru the channel. Excavating operations were completed in six weeks after which a diver made an inspection of the trench.

Seawall Entrance . . . Meanwhile, at the steam plant bulkhead, underground crews were building the seawall duct entrance, an adjoining manhole, and 160 ft of 4-in., six-duct bank to tie it to an existing underground system in the plant yard. The cable entrance had purposely been located along the bulkhead where pile clusters would not be required but where a 10-in. double channel wall would protect the cables.

Five-inch galvanized steel couplings were cast in the wall of the two-way manhole to provide a rigid support for cable armor clamps. To avoid constructing an outer coffer-dam at the bulkhead, a diver using an underwater electric arc torch cut the six 8 x 18-in. holes in the steel piling bulkhead, taking approximately an hour to cut each hole.

Because our cathodic protection scheme called for protecting both the cable sheath and armor, the last 10-ft section of each 5-in. conduit had to be insulated from the bulkhead. After the conduit was shaped and wood plugs inserted in the four unused ducts, a cold-applied coating combination of No-Ox-Id "GG" and Wrapper, with a uniform thickness of No-Ox-Id Filler Red "C" was applied overall. The ducts were then wrapped in asbestos tape to protect the coating while a diver passed them thru the bulkhead from the outside. All ducts were then swabbed with cable-pulling grease.

Equipment . . . For the cable-laying operation, tandem cradles were constructed of heavy timbers on a 20 by 60-ft wood barge and securely blocked and braced. The steel reels, measuring 96 in. in diameter by 8.5 ft wide, each carried 3,030 ft of cable and weighed approximately 47,000 lb. The cable used was 350,000 cir *mil*, three-conductor, 15-kv, paper insulated, shielded, and lead covered, with galvanized armor rods and a jute covering overall.

The reels were mounted so that the cable was taken off the bottom of each reel, with the cable coming off the forward reel passing beneath the reel mounted closest to the play-out guides. The reels rotated so as to roll forward along the cable route. A play-out guide was constructed of two automobile tire rims mounted between horizontal rollers with the base extended and curved to form the slide-off plate. This device served to handle one cable, while a temporary roller arrangement was used for the other. A "Walkie-Talkie" was brought aboard to maintain radio communication with mobile units ashore.

Cable-laying . . . The first step consisted of pulling the cables into the manhole by means of a power winch line fished through the entrance ducts. A diver guided the cables into place and inspected them for kinks before the barge was moved away from shore.

By observing the angle at which the two cables entered the water, and applying braking tension to the reel whose cable was slack, or speeding up the reel whose cable was taut, it was possible to maintain the same rate of feed from each reel. Approximately 75 ft of cable per minute rolled off the reels.

Stakes were used to mark the turn in the route. Although the tide was out when the flats were reached, the cable-laying barge and tugs were able to move through our specially prepared channel to complete the cable-laying operation without delay. At Fisher's Island the material barge was brought alongside to take on the remaining length of cable required to reach the pothead poles. After this distance had been carefully measured, the cable was taken off the reels and coiled in a "figure eight" pattern on the barge. Pulling eyes were formed from the armor and the cables pulled ashore by a waiting tractor.

On the following day two divers

walked the trench to remove any kinks in the cable, and push it into the trench where it had fallen to the side. The trench was then backfilled from the same mounds of sand taken out during its excavation.

Cathodic Protection . . . For submarine crossings, isolating lead sheath from system neutral is our standard practice. Cathodic protection can then be applied to the cable sheath and armor with a minimum current to reduce:

1. Local cell action on the lead sheath and armor.

2. Electrolytic action between the lead sheath and armor.

3. Electrolytic action between the cable and nearby metallic objects.

For this purpose, two 4 by 4-in. by 6-ft magnesium anodes, spaced 25 ft apart were laid on the bay bottom near the duct entrance. No. 6 rubber-insulated, neoprene-jacketed leads were then pulled into the same ducts used for the submarine cables. In the manhole the lead sheath, armor wire, and conduit were bonded together and connected to the anode leads. A negative potential of 1.11 v measured with respect to a copper sulphate half-cell is maintained on the cable sheath and armor. The installation is scheduled for inspection and testing every three months, with replacement of the anodes expected every two years.

Cable installation tests made with our portable Kenotron set consisted of applying a 70-kv d-c potential between the conductor and shielding tape and measuring the leakage current for 5 minutes. Each conductor was tested separately.

Jetting Down . . . In Norris Cut the submarine cable was laid with much less advance preparation. Because only small boats can get thru the shallows here no trench was required. But keel marks on an existing cable at this location indicated that jetting down the new cable would be necessary to protect it, and keep it from shifting with the tide.

An underground crew was brought out by boat each day to the equipment barge anchored near the cable. Two divers, regular company men, alternated in spending an hour each below the maximum 12-ft depth of water. Working with the current to their back to carry the displaced sand away, they moved a high-pressure stream of water along the side of the cable to jet down over 50-ft of cable per hr to a 3-ft depth. A 4-in., 40,000 gph centrifugal pump working into a 2-in. high pressure hose provided the water pressure. No nozzle was necessary. The divers wore a shallow-water-type hood with large vision windows.

An air compressor was adapted to supply air to the divers thru a device built by C. F. Brockway, the crew foreman. In this device air at 105 psi from the compressor is reduced to 40 psi by a regulator and fed into the base of a vertically-mounted water tank. By bubbling the air thru the 5-ft column of water, all traces of oil and gas fumes are removed.

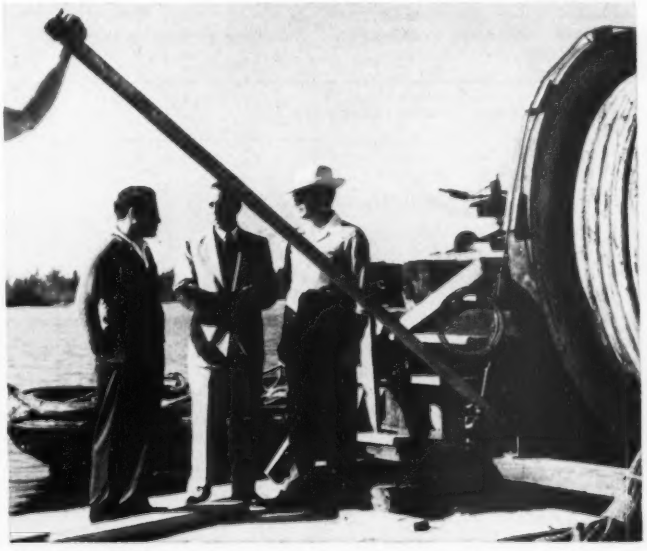
The high-voltage d-c insulation tests on the cable were made by bringing the test truck out to the location on a barge and operating it by means of a portable generator.

Dollies . . . At Bear Cut, the cable was strapped to a messenger clamped beneath the 2,700-ft bridge which links Virginia Key and Biscayne Key. Because of the swift current under the bridge, working from a barge would have been both difficult and dangerous; a painter's scaffold much too slow, for it would have to be set up 40 times to make one pass beneath the bridge. The problem was solved by constructing dollies that could ride the length of the bridge on the longitudinal I-beams. By careful design, there was room enough to allow workmen lying flat on the dolly bed to pass beneath the bridge diaphragms.

On the first pass beneath the bridge, mounting angles to hold the messenger clamps were welded to 75 bridge diaphragms spaced 25 ft apart. While welding was in progress the only equipment parked on the bridge deck was the welding machine and maintenance truck. To make provision for a future cable installation, an additional set of mounting angles was welded on at the same time. Suspension clamps were then bolted to the mounting angles.

The ½-in. high-strength messenger was given a pre-stress tension of 6,000-lb for a period of 12 hr, after which it was slacked off to a tension of 3,000 lb and bolted in the clamps. Cable was pulled in from manholes at each end of the bridge to midspan where splices were made.

Single-conductor, 300,000 cir mil, 15-kv, rubber-insulated, shielded, and neoprene-jacketed aerial cable was used. The three single-conductor cables were pulled simultaneously with a single-swivel pulling-eye, and strapped to the messenger at 20-in. intervals with No. 8 cable straps. To give the straps protection from salt spray, they were coated by dipping once into primer, and twice in neoprene paint. High-voltage d-c insulation tests consisted of applying 63 kv between the conductor and shielding tape.



BRAKING MECHANISM consisted of 1 by 6-in. wood blocks fastened along a ½-in. wire rope placed on one flange of each reel. One man operated brake with 10-ft. pipe lever.

Quicker Voltage Regulator Response

Here is further proof that a change to quick-response automatic voltage regulation will improve machine performance by adjusting generator voltage to a safe value quickly, when load changes threaten stability

H. A. CORNELIUS, Engineer, Electric Station and Substation Design, Public Service Co of Northern Illinois

W. F. CAWSON, Design Engineer, Public Service Co of Northern Illinois and

H. W. CORY, Ass't Engineer in Charge, Control Station, Allis-Chalmers Mfg Co

High-speed, automatic, voltage regulation promotes stable operation of a generator by increasing its field voltage to maintain the transient field current. This has been proved by tests on the Public Service Co of Northern Illinois system.

Among the operating experiences that led to the tests was this: A 65-Mva unit tripped out because of mechanical trouble, and a 121-Mva unit at the same station lost synchronism as it attempted to pick up the load dropped by the smaller unit. Records showed that the 121-Mva unit load increased from 85 to 118 Mw for about 15 sec and that the bus voltage dropped to about half normal value as the machine pulled out of step.

This machine has a short circuit ratio of 0.66 and had previously pulled out of synchronism during severe system disturbances. It was decided that measures to increase the stability of operation of the machine should be taken. These measures consisted of providing quick response, automatic voltage regulation in order that generator voltage would be adjusted rapidly to a safe value whenever changes in load threatened the stability of the machine.

Study Two Types . . . Preliminary studies were made with both rheostatic and rotating amplifier type of automatic voltage regulation. Consideration was given to changing the shaft-driven generator exciter from nominal 250 v, ceiling 350 v, to nominal 350 v, ceiling 500 v. This change in the exciter was made on the premise that corrective changes in exciter field current would produce a greater and faster response in exciter voltage and thus in the generator field. Results of this study are shown in Fig 1. The relatively slow response of the rheostatic type of regulator eliminated it from consideration.

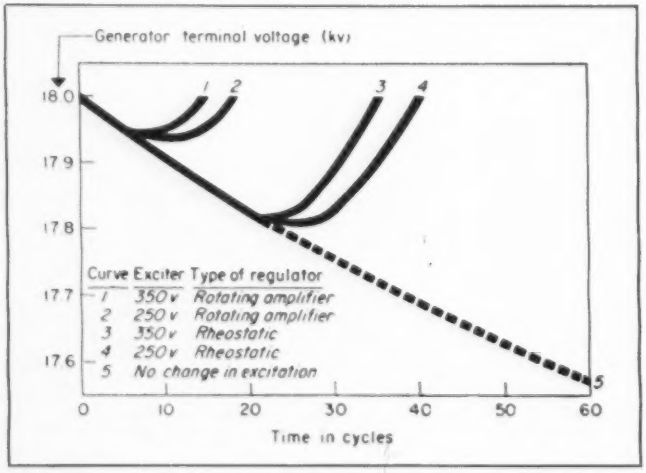


FIG. 1—Comparison of regulator types shows time required to restore generator terminal voltage during change in generator load from 68 mw to 121 mw

Transient Stability Studies . . . To gather more data, transient stability studies were run with the generator connected to the system under the most adverse of normal operating conditions. Curves on exciter voltage pick-up when the automatic voltage regulators called for a raise in generated voltage were supplied by the manufacturer. These curves started from an initial excitation of 190 v. This was equivalent to the voltage required for a normal load of 60 Mw on the unit under the operating conditions to be studied.

Influenced by the case of trouble in March, 1947, first studies consisted of the generator initially carrying a normal load of 60 Mw with the mechanical input power to the generator increased to the equivalent of 100 Mw. The system frequency and voltage at the far end of the transmission tie were assumed to remain constant, and the generator exciter voltage was assumed to vary in accordance with the curves supplied.

The system considered, Fig 2, consisted of the 18-kv, 121-Mva, generator connected through a transformer bank to a 132-kv bus. Two 132-kv lines from this bus ran to a transmission distribution center. One line continued on and tied to a 66-kv system through a transformer bank. Studies were made, and the results are shown in Fig 3 and 4.

Without automatic voltage regulation the generator became unstable and fell out of step in three seconds. With automatic regulation, using either the existing 250-v exciter or the proposed 350-v exciter, the generator remained stable.

Change in generator "pull-out" power with time, under the assumed conditions, is shown in Fig 5. The curve of "no voltage regulation" raises a question by showing that when the generator is carrying 60-Mw, it will be stable for a transient load of 120 Mw. Yet, when the power input is increased to 100 Mw, the stability limit decreases as the generator picks up the load. This is brought about by the difference between the steady and transient state operation of the generator.

Steady state conditions exist when the generator field current and arma-

Does Improve Generator Stability

ture current are constant and their opposing magnetic forces producing the generator magnetic flux are constant. This magnetic flux is the deciding factor of generator synchronizing power. When the armature current is increased, the magnetic flux, closely coupled with the highly inductive field winding, cannot make an instantaneous change. Therefore, a compensating current is induced in the field winding. As the induced field current dies away, the magnetic flux decreases; and the generator loses some of its synchronizing power.

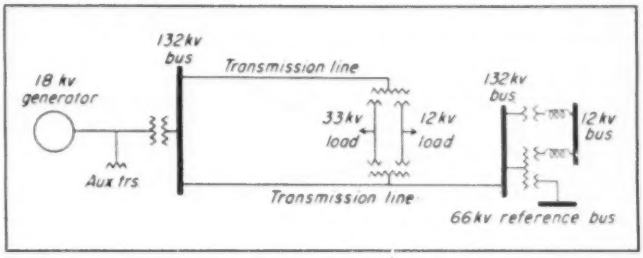


FIG. 2—System considered consisted of 18 kv generator with 132 kv transmission lines feeding sub-transmission and distribution systems

Automatic Regulation . . . If field current could be maintained at its original value plus the induced value, the magnetic flux and synchronizing power of the generator would be maintained. The studies showed that automatic voltage regulation would maintain the field at its induced value, would further increase the field current, and give the generator an additional factor of safety. This is shown by the "automatic voltage regulation" curves in Fig 5. Superiority of the proposed 350-v exciter with a 500-v ceiling in building up a safe operating margin prompted the decision to use a 500-v ceiling exciter with a rotating amplifier voltage regulator.

Maintain Minimum Excitation . . . Equipment to prevent lowering the generator excitation below a safe minimum value was also installed. This was considered particularly desirable because a large number of capacitor installations has raised the system power factor. This has reduced the amount of excitation current required on the generators and thereby caused them to have less magnetic flux and, therefore, less synchronizing power.

The solid line of Fig 6 shows the

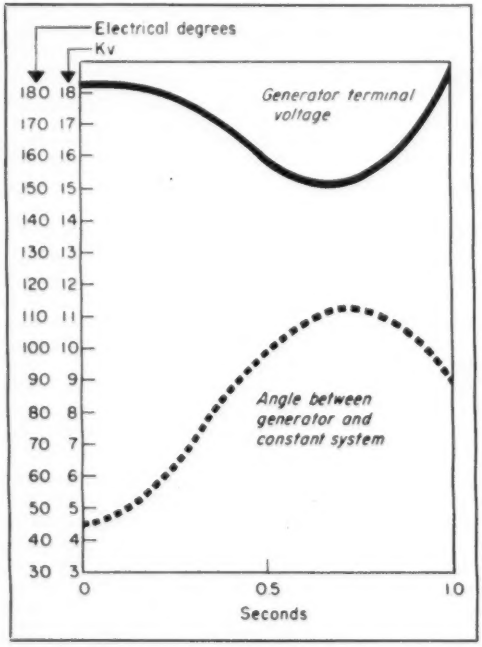


FIG. 3—Generator became unstable within three sec when input power was increased from 60 mw to 100 mw without making any compensating change in excitation

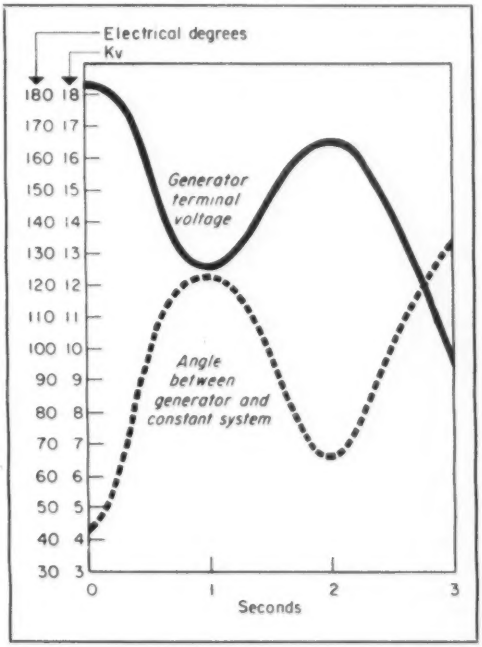


FIG. 4—Generator remained stable when input power was increased from 60 mw to 100 mw with automatic voltage regulation using 350 v exciter. The curves for the 250 v exciter were similar to these

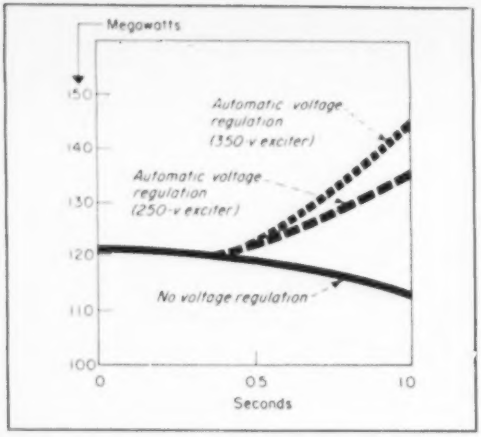


FIG. 5—Generator pull-out limit changes with time as load is increased from 60 mw to 100 mw

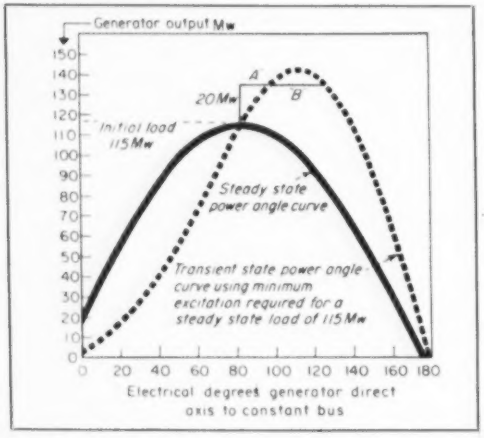


FIG. 6—Stability conditions were determined from power angle curves showing steady state and initial transient state conditions. Area "A" must not exceed area "B" for safe operation

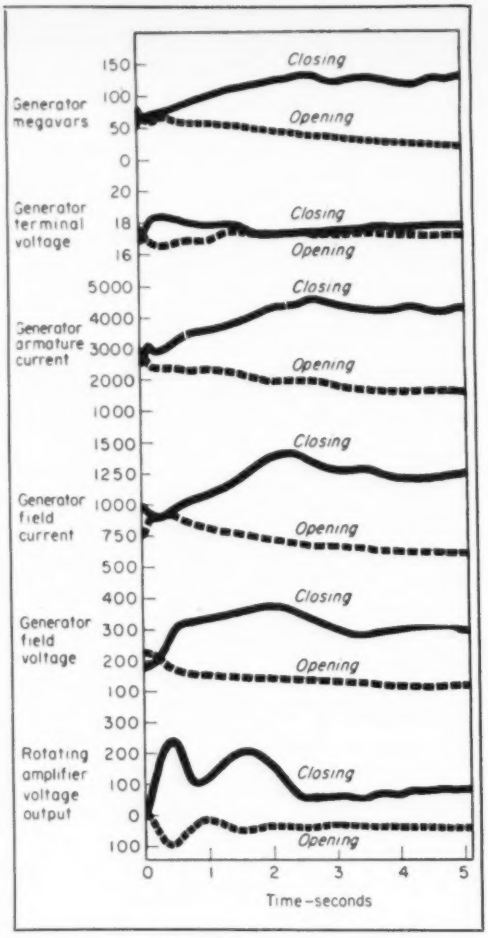


FIG. 7—SUMMARY OF RESULTS of test oscillograms taken when opening and closing in on short circuited line after installation of automatic regulating equipment

power angle diagram for the system voltage as well as the voltage behind generator synchronous reactance, for the circuit under consideration. Excitation is a minimum value for steady state stable operation at a load of 115 Mw. Assuming that the generator was operating at 115 Mw and that the direct axis component of the voltage behind transient reactance would be initially constant during a load swing, i.e., the flux linkages would remain constant, a second power angle curve was drawn and is shown by the broken line curve of Fig 6.

Permissible change in generator loading, before the generator loses synchronism, is also shown in Fig 6 where area "A" must not exceed area "B" for safe operation. These curves show that the generator could operate steadily at 115Mw and could recover from an increase in load of 20 Mw providing the excitation could be increased before the transient induced field current died away.

Studies had indicated that high speed automatic voltage regulation could promote stable operation of the generator by rapidly increasing field voltage. Power angle diagrams indicated that with automatic voltage regulation and an initial generator load of 115 Mw under the system conditions considered that:

1. With minimum excitation for steady state operation, the generator could recover from a power swing to 135 Mw.

2. With excitation 5% above minimum requirements, the generator could recover from a power swing to 160 Mw.

3. With excitation 10% above minimum requirements, the generator could recover from a power swing to 170 Mw.

Equipment Tests . . . The rotating amplifier voltage regulator and a 350-v exciter, with a 500-v ceiling, were placed in service Sept. 24, 1949, and the minimum excitation feature Dec. 4, 1949. When the voltage regulator

was placed in service, tests were made to determine the reaction to unusual operating conditions.

With the rotating amplifier in service but with its output reduced to zero, the driving motor was shut down with no noticeable effect on the generator voltage. With the rotating amplifier in service and carrying load, the motor feed was switched off. The rotating amplifier tended to carry its load almost to a full stop and then lost its output, reducing the generator voltage. There was no tendency for the amplifier generators to motorize.

Various rectifiers in the control circuit were short circuited, to represent individual rectifier failures. There was no noticeable effect on the output of the regulator.

To show the effect of "blown" generator potential transformer fuses a secondary phase lead to the voltage comparator was opened. Because of the star-delta potential transformer connections this was equivalent to blowing two of the high side fuses. Under this condition the rotating amplifier output went to 180 v in the direction to increase the generator field. Under some operating conditions this would be detrimental to the generator. Therefore, an alarm was installed to give the operator an audible signal when the amplifier output exceeds 50 v.

Operational Tests . . . After the automatic voltage regulator and the minimum excitation feature were placed in service, tests were made to determine the behavior of the equipment during faults and abnormal operating conditions on the system.

A three-phase fault was applied to a 132-kv line about 115 miles from the station's 132-kv bus. With a load of 20 Mw on the 115 Mw generator it was connected through the transformer bank to the faulted 132-kv line. The oscillograph records, summarized in Fig 7, showed an increase in the generator field current because of the induced field effect, but no corresponding increase in field voltage. After the first quarter-second the drop in generator terminal voltage caused the rotating amplifier to (1) increase the exciter voltage enough to maintain the induced field current and (2) further increase the generator field current to maintain the generator terminal voltage at the pre-selected value.

When the station breaker operated to disconnect the generator from the faulted line, the oscillograph records, summarized in Fig 7, showed a decrease in field current, because of the induced field effect. The automatic voltage regulator maintained the decreased field current and thereby prevented excessive overvoltage on the generator.

Select Excitation Setting . . . In consideration of the ability of the automatic voltage regulator to maintain stability, the minimum excitation feature is set for 5% above minimum requirements at full load on the generator. The calculated relationship between the power and reactive loading of the generator, under minimum excitation for generator stability for the system conditions studied, is shown in Fig 8 by the curve marked zero margin. Curves also show calculated relationships with 5 and 10% additional excitation above minimum requirements for stable operation.

Minimum excitation control is shown by the dashed line in Fig 7. The circled points were obtained by means of tests made to check the settings.

Check Output . . . Normal procedure is for the operator to check periodically the output voltage of the rotating amplifier and adjust it to zero output by means of the manually operated field rheostat. This is to prevent any undue change in generator terminal voltage in event of auxiliary power supply failure to the motor of the rotaing amplifier.

Operating personnel have been pleased with performance of the voltage regulator. It has proved of great assistance during rapid load changes and switching operations which involve changes in the reactive loading of generators.

A number of system troubles have occurred since the automatic voltage regulator has been in service. In each instance the oscillograph records show that the regulator operated to maintain normal terminal voltage on the generator, and it remained stable. Previous experience, on the other hand, indicates that the generator would have become unstable during some of these disturbances when manually controlled. This confirms the advantage of quick-response regulators.

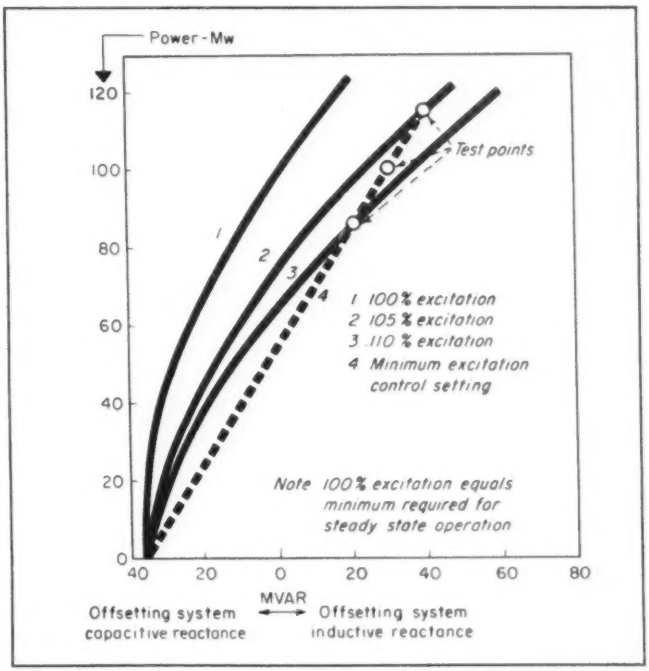
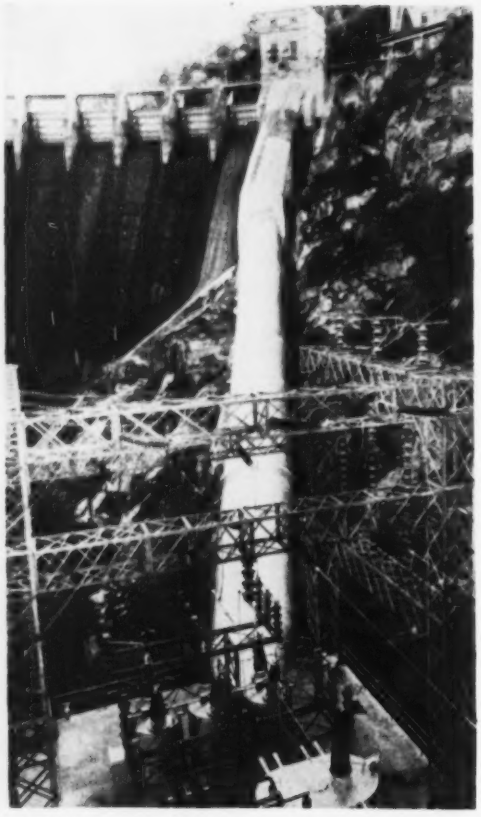
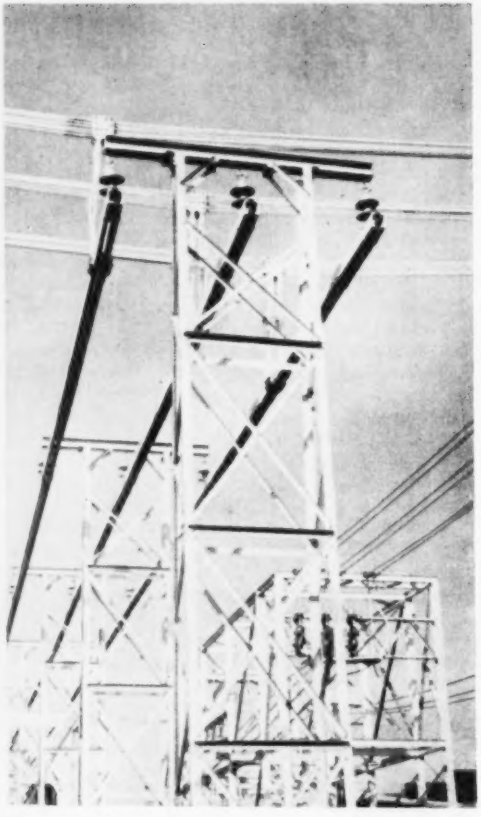


FIG. 8—Setting at 5% additional excitation was chosen after studies showing relationship between generator load and reactive with minimum excitation for stability. Studies considered 5% and 10% additional excitation and values permitted by minimum excitation control



SUBSTATION STRUCTURE made from extruded aluminum alloy shapes looks good, can be built quickly, and requires little maintenance. Light weight of structural members and high resistance to corrosion aid assembly



SWINGING CHANNEL BUS is very effective method of installing bus subject to short circuit conditions. Buses are suspended on "A" frame by ball and socket type insulators. Arrangement relieves shock in bus when disturbed by short circuit conditions

How to Install High Capacity

Experience with high capacity aluminum buses at the Alcoa, Tenn., works of the Aluminum Co of America provides key to proper application and jointing practice in utility and industrial substations

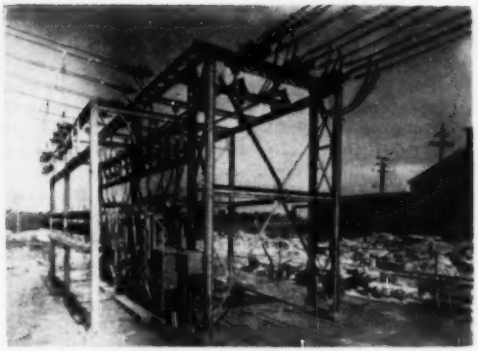
Aluminum bus conductors have been used in factories and commercial buildings for more than 56 years. Today outstanding installations have been made in steel mills, chemical plants, electro-chemical plants, storage battery rooms, central stations, and substations. The accompanying pictures illustrate some of their many applications in these fields.

J. **ELMER HOUSLEY**, District Power Manager, Knoxville Power Co, Alcoa, Tenn.

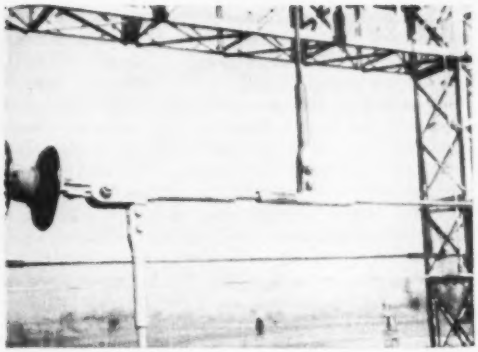
Rectangular Bus . . . Of all types of aluminum bus conductors, those of rectangular cross section are the most commonly used. The Alcoa Works has used aluminum bus on switchboards for many years. In no instance has the aluminum bus been involved in an interruption to service even when attached to copper studs.

The capacity of a bus constructed of flat bars may be controlled by varying the number of bars or laminations in parallel. For heavy alternating currents, special arrangements of laminations are used to avoid reduction in current carrying capacity of additional bars by the reaction of the magnetic field around the laminations which upsets the uniform distribution of current in the bus.

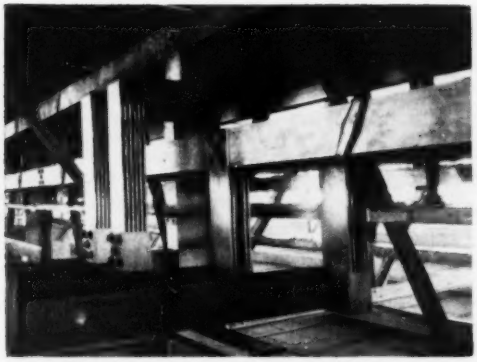
The early method of splicing rectangular aluminum bus was by bolting. When contact surfaces are throughly cleaned and a suitable com-



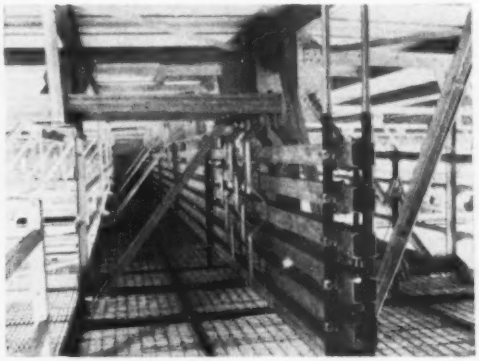
MULTIPLE CABLE BUS—1,000,000 cir mils, dead-ended to structure with bolted type strain clamps (line at left). Strain clamps aid cable length adjustment. Cables entering structure at right are dead-ended with compression type fittings



CABLE BUS all-aluminum conductor carrying 150,000 kw at 161 kv is 500,000 cir mils. It is dead-ended to insulator string with compression dead-end body. Tee-tap has bolted joints with flat surfaces protected by joint compound



RECTANGULAR BUS is easy to fabricate, store, and erect. Large surface of multiple bar buses dissipates heat faster. Joints and taps are readily made by overlapping. Bending and forming are simple operations



CHANNEL BUS has flat surfaces for making taps and connections. Rigidity and strength permit unusually long span construction. Such bus also withstands extreme short circuit forces. Space required is generally less than other equivalent shapes

Aluminum Buses

pound is used to prevent entrance of air and moisture into the joint, excellent results can be obtained with bolted connections.

High capacity rectangular buses with bolted joints have been used successfully at the Alcoa Works for many years. For heavy duty d-c buses, high strength steel bolts are used. Steel composition used is SAE No. 1335 with a yield strength of 100,000 psi. A special steel washer is used to maintain uniform tension in the bolt. Contact surfaces of the bus are cleaned and lightly coated with a suitable soft, grease-type compound, and the surface scoured with emery cloth without removing the joint compound. This method insures that the joint surface will not reoxidize when contacted with air. Additional joint compound may be applied to fill voids in the contact surfaces. After the joint is assembled, the spring washer is pulled up until flattened and the bolt nut is backed off ¼ turn.

Channel Bus . . . Buses consisting of two aluminum channels placed to form a hollow, ventilated square are particularly efficient as to losses and practical for large alternating and direct currents, especially above 2,000 amp per circuit. It approaches the electrical efficiency of a split tube and has the advantage of having flat surfaces for making taps and connections.

Where space for bus installations is at a premium, it is often desirable to install power buses above valuable working space by placing them on roof trusses, building columns, or similar unused locations. Also, the light weight and rigidity of channels do not materially increase the roof load. This type of bus is also convenient for bus risers. Because it is a bare conductor, periodic inspection as well as connection changes are facilitated; and there is no deterioration of insulating materials.

Aluminum channels are available in sizes from 3 to 12 in. and for currents ranging from 2,000 to 12,000 amp.

Tubular Bus . . . Tubular aluminum conductors are made in standard pipe sizes from ¾ to 6 in. A number of advantages have led to the wide adoption of tubular bus conductors for outdoor substations and switching station construction. Shape gives tubular buses equal rigidity in all directions, an advantage in withstanding ice, wind, and short circuit loads. The cylindrical surface effectively obviates corona discharge at high voltages, and it is efficient where skin effect is concerned.

Since transformers and associated apparatus in high voltage switching stations are large, long bus spans are usually required. At the same time the current carrying requirements are relatively low. When it has sufficient current carrying capacity, thin wall aluminum tubing can be used to advantage. Its structural stiffness and light weight eliminate large unsightly conductor spans. The smaller deflection, resulting in better appearance, is an important feature in some locations.

Tubular conductor is commonly used for heavy-duty generator and switching buses in central stations. Although such buses are supported on porcelain insulators, it is not uncommon for them to be insulated throughout their length to prevent accidental short circuit faults.

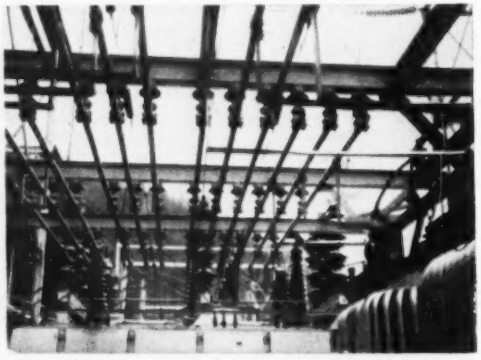
Argon Arc Welding . . . A development in the field of arc welding aluminum involves the use of a metal arc, a tungsten electrode, and argon gas envelope. The mechanical properties and soundness of welds made with the argon arc are exceptionally good. Since no welding flux is used, no cleaning operations are necessary subsequent to welding.

In welding aluminum, an a-c arc in argon gas is used. The argon atmosphere protects from oxidation both the tungsten electrode and the aluminum being welded. The molten pool is bright and clean, and good coalescence is obtained between the parts welded.

While no long time corrosion tests have been completed, the results of accelerated tests and the fact that no welding flux is used indicate that the resistance to corrosion of argon arc welds on aluminum is equal or superior to that obtained by other fusion-welding processes.

In nearly all cases, the Alcoa Works now uses the argon arc method on aluminum bus connections.

Current Carrying Capacity . . . Since the loss in a conductor is proportional to its length, the current density in a short length bus may be higher than in a long transmission line. In the line the limiting condition which determines conductor size is voltage drop while in the bus temperature rise is generally the limiting condition. However, economic considerations always involve a balance between the investment required to prevent losses and the value of the power saved. Therefore, when large bus currents are involved, economy may dictate that the energy loss be the limiting factor rather than temperature rise or voltage drop.



TUBULAR BUS gives equal rigidity in all directions and withstands ice, wind, and short circuit loads experienced in outdoor construction. Symmetrical cross section facilitates bending to form turns and offsets

Painting Bus Bars . . . By painting aluminum bus bars with a flat-finish paint with non-metallic pigment, the current carrying capacity may be materially increased for a given temperature rise. This improves the heat-dissipating characteristics and the normal temperature rise ratings may be increased 15 to 20%. At the same time the power loss is increased with an increase in current. The color of the paint does not affect its emissivity to any appreciable extent.

Expansion Joints . . . Since aluminum has a coefficient of linear expansion of 0.000023 per degree Centigrade, the total expansion in a continuous bus run of 50 ft would be 0.69 in. at a temperature rise of 50 C. This would amount to 0.35 in. from the center to each end. Therefore, all structural types of aluminum bus conductors should be designed for freedom of longitudinal movement except at anchor points. Tubular buses are usually employed in substation work where the total continuous length is seldom long. However, runs of considerable length do require expansion joints, particularly if there is a large diameter tube terminating at both ends in electrical equipment which should not be highly stressed.

There are many variations in design of expansion joints. For flat bar or structural shapes, the expansion strips are usually made up of thin laminations. A number of aluminum sheets, 0.010 to 0.016 in. thick, have the ends welded to solid lugs in order to facilitate attachment to the bus.

Short Circuit Forces . . . Bus design is in most cases dependent as much on the magnitude of probable short circuit forces as on the normal load, because the permissible length of span depends on the mechanical force it must withstand and on the strength of the conductor. For example, channel aluminum conductors being strong and stiff permit long spans and fewer supports; but where short circuits are likely to be high, the maximum permissible span may be limited by the strength of the insulating supports.

Where channel or angle buses are subject to heavy short circuits, the design should include for each pair of conductors, spacer clamps placed intermediately between insulator supports. An effective method of installing channel bus subject to short circuit conditions is shown in the "Swinging Channel Bus" picture on page 112.

Adapted from recent Southeastern Electric Exchange paper

WASHINGTON COMMENT

JESSE MOCK

Most of you know something about the numerous polls conducted to forecast the outcome of political elections. During the past two presidential elections they have been notably off-base.

Will The Next Congress Favor Public Power?

You are perhaps less familiar with the surveys or studies made after elections to determine their significance. These studies receive little or no publicity and are generally for the private use of individual organizations which have a big stake in the actions of Congress. They are one of the guides which these organizations use in planning their work for the year ahead. For that reason, it is interesting to take a brief look at the conclusions of some of these surveys made by organizations advocating federal power development.

The National Farmers Union, for instance, is a strong supporter of federal power projects and rural electrification including generation and transmission cooperatives. At times it seems every bit as concerned with electric power problems as with the more direct farm problems of soil, crops, and marketing. This is what NFU has to say about the new Congress.

"In general, the new Congress will be less sympathic to farm programs than the one it replaces. But exactly how they will fare hinges on the larger question of what general course the new administration will steer."

NFU Cool on the Next Congress . . . NFU is plainly unenthusiastic about the committee leadership of the 83rd Congress but seems to hold out hope that the new President may be more sympathetic to a part of the organization's program. With some support from Eisenhower, NFU thinks proposed legislation will have much easier going.

Another federal power organization in Washington, which prefers to remain anonymous but which has been fairly well pleased with the Truman program, has also made a casual survey as to what it may expect from the next Congress. This survey shows that on power matters such as the preference clause, federally constructed transmission lines, and multipurpose projects, the new Congress will not be far different from the present one. From the point of view of this organization, federal power advocates have little to fear from Congress.

NRECA Not Encouraged . . . National Rural Electric Cooperative Association has published its own survey of the next Congress. On the basis of its study, NRECA concludes, ". . . the situation in Congress . . . is not encouraging."

While this organization's first interest is the role to be played by Rural Electrification Administration, it also is a firm supporter of other aspects of federal power policy. It wants to keep the way clear for government financing of generation and transmission co-ops. NRECA has backed a number of proposals for federally constructed transmission lines and for federal water and power projects.

NRECA guesses that 41 members of the incoming Senate should be relatively friendly to its program, and there are eight new Senators whose views are unknown. This compares with 45 Senators which NRECA terms "friendly" in the present 82nd Congress.

On the House side, NRECA figures there will be 164 members favorable to their program and 90 whose views are unknown. This compares with 210 considered friendly in the 82nd Congress and eight whose views were unknown.

Concludes NRECA: "The fate of the rural electric program (of NRECA) in the Senate will depend on the ability of rural leaders to win over some of the new Senators, on the attitude of president-elect Eisenhower and the power of Republican committee chairmen—almost all of whom are, on voting records, unfriendly to the program.

This survey is based almost entirely upon the voting records of law-makers. Since record votes are taken on a relatively few issues each year, the study admittedly does not give a clear picture of what may be expected.

There are some competent observers in Washington who believe such surveys are a waste of time. That may be. Nevertheless, several organizations use the results of such surveys to orient their lobbying activities.

TECHNICAL NOTES

ARCHER E. KNOWLTON

(Items adapted from identified papers of ASME 1952 annual meeting)

Mechanical ash collector installations are generally cheaper but do not give the cleanup possible with the more expensive electrostatic precipitators; however, unfavorable electrical characteristics of the ash may impede expected results with the latter. (69)

High nickel content (say more than 40%) alloys are prone to corrode when exposed to high temperature flue gases of a reducing nature and containing sulfur. (37)

Effects beneath the metal surface as well as metalscaling and surface loss are important considerations in applying cast Fe-Cr-Ni alloys in oxidizing and reducing flue gas atmospheres at high temperatures. (37)

Filtering and centrifuging are generally ineffective in removing ash-forming constituents because they are commonly in dissolved form in the fuel oil. (127)

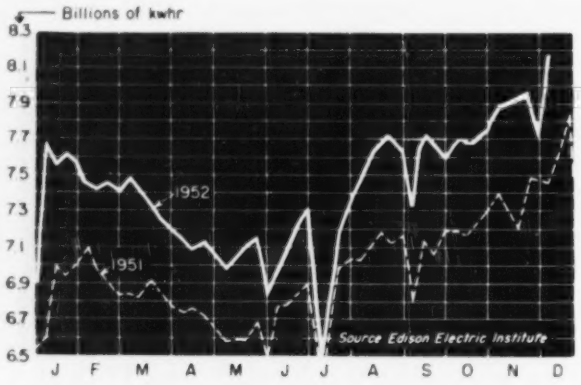
Ash-formation prevention in gas-turbines using fuel oil is likely to focus on the turbine blading and combustion system because resort to distillation (filtering and centrifuging proven ineffective) will probably be uneconomical. (127)

Partially incomplete combustion of fuel oil gas gives deposit-free blading of a gas turbine. The relatively large droplets apparently carry the ash through to the exhaust with the unburned carbon. (127)

Ash from burning residual fuel oils seldom exceeds 0.1% in weight but even this much can give trouble in gas turbines. (127)

Vanadium content of fuel oils begins to be severely corrosive at 1100 F and gets worse rapidly at higher temperatures. (127)

STATISTICS



Output Week Ended Dec. 6—8,165,463,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Dec. 6	+9.7	+14.7	+7.7	+11.7	+9.4	+13.3	+8.6	+9.3	−4.3	+9.3
Nov. 29	+3.0	+2.0	+0.1	+3.0	+5.1	+5.8	+5.7	+6.0	−4.5	+5.2
Nov. 22	+11.4	+23.1	+10.5	+13.8	+12.4	+10.6	+13.9	+7.3	−4.7	+13.9

Electric Power Statistics

Peak Load (Million Kw)	Sept.	69.7*	69.7	64.7
Capacity (Million Kw)	Sept.	78.78	78.31	74.29
Production (Billion Kwhr)	Sept.	33.38	34.36	30.25
Hydro		7.36	8.52	7.03
Fuel		26.02	25.84	23.24
Fuel Consumption				
Coal (Million Tons)	Sept.	8.82	8.57	8.60
Oil (Million Barrels)		6.03	5.38	5.06
Gas (Billion Cu Ft)		97.37	104.97	77.34
Sales (Billion Kwhr)	Sept.	30.11	29.39	27.54
Residential		7.66	7.53	6.82
Commercial		5.37	5.46	4.89
Industrial		14.75	14.10	13.62
Other		2.33	2.30	2.22
Net Income Class A & B Companies ($ Million)	Sept.	73.12	68.67	58.95
Estimated Dec. 52 Peak (Million Kw)	Sept.	79.7	80.0	80.3
Kwhr per Residential Customer (12 Month Average)	Sept.	2,131	2,119	1,961
Revenue per Kwhr Residential Service (12 Month Average)	Sept.	2.77¢	2.77¢	2.83¢
Canadian Production (Billion Kwhr)	Sept.	4.99	4.97	4.41

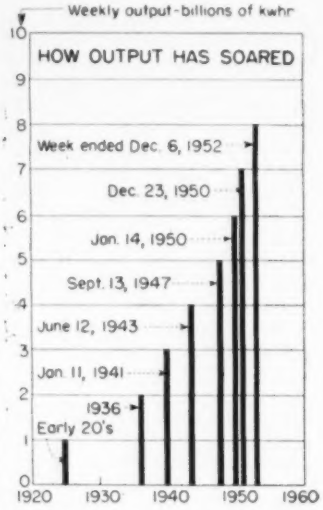
Business Statistics

FRB Industrial Production Index†††	Oct.	231*	231	222
Gross National Product Annual Rate ($ Billion)	3rd Qtr.	344.0	343.2	337.1
E. W. S Industry Production Index	Oct.	126.5	125.8	122.1
ENR Construction Cost Index††	Nov.	121.1	120.7	114.7
BLS Consumer's Price Index	Oct.	190.9	190.8	187.4
NEMA Insulation Materials Sales Index†	Sept.	531	451	521
NEMA Electric Appliance Sales Index†	Sept.	231	236	265
NEMA Household Refrig. Sales Index†	Sept.	136	148	114
Metal Prices, (Dec. 3)				
Copper, Conn. V., lb.		$.24½	$.24½	$.24½
Lead, N. Y., lb.		.14	.14	.19
Zinc, prime Western E. St. Louis, lb.		.12½	.12½	.19½
Tin, Straits, qual. N. Y. lb.		1.21⅜	1.21¼	1.03
Aluminum, ingot, base price		20	20	.19
Nickel, base price		56½	56½	56½
Steel, billets, Pitts., ton		59.00	59.00	56.00
Steel, scrap, No. 1 heavy, Pitts., ton		45.00	45.00	45.00

* Estimated. † 1936=100 †† 1949=100 ††† 1937-39=100 (Unadjusted)

8 Billion Kwhr, All in One Week

The industry's output for a single week has finally topped the 8-billion-kwhr mark. Total for the week ended Dec. 6 was 8,165,463,000 kwhr (See statistics at left). It was just about two years ago that the first 7-billion-kwhr week went into the records.



The chart above illustrates industry growth since 1920. It was in the "golden '20's" that the industry really got going. Practically all urban homes were electrified in this decade, the demand for home appliances started, and the private companies started to boost rural electrification. During this time the industry first succeeded in producing 1 billion kwhr in a week. It had taken some 40 years to reach this significant figure.

In the years following changes in record keeping were made, but 1936 is considered the year when the 2-billion-kwhr mark was reached. Then with World War II, the demand for electricity really started to soar. There was a slight postwar drop, but it didn't last. Postwar expansion kept driving output upward. As this was letting up, the Korean episode gave the industry its greatest boost. In 49 weeks of 1950, output rose from 6 billion to 7 billion.

The present outlook is that it won't be too long before the 10-billion-kwhr mark is reached.

Kitsap PUD Makes Changes . . .

. . . after voters elect C. E. Ferguson a commissioner and a strong opponent of the purchase of Puget Sound P&L properties

With a majority of the Kitsap PUD commissioners at Port Orchard, Wash., opposed to the proposed purchase of the Puget Sound Power & Light Co as the result of the Nov. 4 election, the newly constituted commission rescinded actions taken by the pro-purchase commissioners in recent years.

Myers Fired . . . C. E. Ferguson, who won the election over a pro-purchase commissioner Nov. 4 after waging a strong campaign against the purchase, lined up with James W. Bryan, Sr, incumbent, who long has opposed the purchase. Together, they revoked the assignment of Kitsap County interests to five other PUD's for a proposed five-county purchase of Puget Power properties and dismissed Guy C. Myers of New York as fiscal agent for the PUD.

They also designated Bryan as attorney for the district, as well as chairman, and disposed of a pending resolution that called for the hiring of J. Harvey Leach, Puget Power Kitsap manager, in the same role for the PUD at $11,000 a year upon completion of the purchase.

New Plan . . . "I want everybody from here to Boston (the Puget Power home office) to know we have a plan now that is most definitely contrary to what has been the pleasure of this body heretofore," Bryan declared. He wants the PUD to acquire Puget Power's distribution facilities in the county, a move that Pres Frank McLaughlin of Puget Power declares would break up the company's integrated system, and buy power from the Bonneville Power Administration.

Legality of the commission's actions is in question, however, as Bryan's right to hold office has been challenged in court. A suit alleges that he was not a resident of the district from which he was elected.

Action Invalid . . . McLaughlin described the PUD action in revoking the consent given the other five districts to acquire the company's property in Kitsap County as "invalid." He declared "there exists a binding, enforceable contract for the purchase of the company's property."

McLaughlin branded the "tactics" of Bryan and Ferguson as "incredible and unconscionable, especially in the light of the regional power shortage."

Hearing Jan. 20 . . . Meanwhile, Judge Max Church of Kitsap County Superior Court at Port Orchard held over until Jan. 20 a hearing on the making permanent of a temporary injunction restraining the Kitsap PUD from participating in the proposed purchase.

This date will be four days after the state supreme court hearing at Olympia on a petition of the involved PUD's and the Puget Sound company that the temporary order of the Kitsap County Superior Court be dissolved.

Judge Church continued the hearing after a two-hour session on Dec. 2 in which four attorneys argued the legal points.

The legal maneuvering started when the newly elected Ferguson asked the restraining order to delay any action on the purchase until after he was seated Dec. 1.

In the interim, Commissioners C. Jack Jones, whom Ferguson unseated, and Thomas A. Ross, who also favored the purchase, voted for a resolution of consent to permit the five other PUD's to take over the Kitsap share of the purchase. Such consent is legally required when a PUD proposes to buy properties in another county.

Contempt of Court . . . Judge H. G. Sutton, in whose court Ferguson had filed the petition for injunction, declared he would cite the commissioners for contempt of court if they did anything to make their resolution effective. PUD attorney filed a motion of prejudice against Judge Sutton, removing him from the field, but Judge Frank W. Ryan, the second Kitsap County Superior Court judge, signed an amended order with a more specific prohibition against action relating to the purchase.

FINANCIAL BRIEFS

Wheeling Electric Co has put into effect bi-monthly billing plan for domestic and small commercial customers. When the entire change over is completed, company expects to save $4,500 annually on postage alone. Industrial and larger commercial customers will continue to be billed every month . . . **Southern Colorado Power Co** is going to adopt post card customer billing.

Electra, Tex., citizens vote 244-to-44 for $229,000 bond issue for improvements to the municipal power plant and system . . . **Niagara Mohawk Power Corp** has advised common holders of nine or less shares that the corporation has arranged with J. P. Morgan & Co, Inc, to purchase such shares from the shareholders without payment of brokerage commissions or transfer taxes.

Dividends—Duquesne Light Co will pay Jan. 1 the first quarterly common dividend of 37½¢ a share which go into public hands. Previous dividends were paid to the parent, Philadelphia Co, which until last month owned all of the Duquesne common stock . . . **Community Public Service Co** has asked—Federal Power Commission approval to issue 137,181 shares of capital stock to its stockholders as a dividend . . . **Philadelphia Co** has taken no dividend action on its common stock "inasmuch as the company is in process of liquidation, and since the company has recently distributed to its commonholders Duquesne Light Co common stock on a 1-for-5 basis, representing at present market values about $6 per share." . . . **Michigan Gas & Electric Co** will distribute Dec. 26, subject to Michigan Public Service Commission approval, 3% stock dividend on its common.

Raymond B. Frank, Limerick, N. Y., plans to acquire former Frontenac hydro project at Dexter, N. Y., comprising three dams and five power units, from Abe Cooper, Watertown, N. Y. Operation of development will probably be continued under the name of Hounsfield-Brownville Land Corp and the electric output will be sold to Niagara Mohawk Power Corp.

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1952									
Dec. 4	**2 96**	**2 98**	**3 12**	**4 03**	**4 22**	**4 55**	**5 04**	**5 38**	**5 76**
Nov. 26	2 95	2 97	3 12	4 04	4 22	4 54	5 07	5 44	5 82
3rd 1952	2 99	3 03	3 16	4 10	4 26	4 61	5 18	5 59	5 96
2nd 1952	2 95	3 00	3 09	4 05	4 31	4 60	5 38	5 85	6 42
1st 1952	2 95	2 99	3 13	4 11	4 29	4 66	5 35	6 03	6 47
4th 1951	3 02	3 07	3 21	4 32	4 50	4 91	5 42	6 18	6 84

Data: Reis & Chandler, Inc.

EARNINGS

Company	Period Months Ended		Net Income 1952	Net Income 1951	Earnings Per Common Share 1952	Earnings Per Common Share 1951
California Oregon Power	12	Oct.	$2,597,947	$2,375,729	$ ...	$ ...
California-Pacific Utilities	12	Oct.	542,754	437,516	2 05	1 61
El Paso Electric	12	Oct.	1,539,006	1,419,337	1 93	1 77
Gulf States Utilities	12	Oct.	7,107,944	5,881,807	1 84(a)	1 59(a)
Public Service Co of Indiana	12	Oct.	9,959,443	7,995,437	2 44(b)	2 02(b)
Quebec Power	9	Sept.	520,637	469,254	.94	.84
Texas Power & Light	12	Oct.	7,234,242	6,094,808	...	...

Notes—(a) Based on 3,124,168 shares in 1952 and 2,884,590 shares in 1951; and (b) Based on 3,713,279 shares in 1952 and 3,573,907 shares in 1951.

FINANCING

Company and Description	Amount of Offering ($00)	Offering Price	Yield to Public
WEEK OF DECEMBER 4-10			
Preferred Stock			
Commonwealth Edison—1,155,730 sh $25 par $1.40 cum. conv. (being offered commonholders on 1-for-12 basis, record Nov. 24 to expire Dec. 10)	$35,828	$31.00	4.52%
Common Stock			
Western Light & Telephone—65,168 sh (being offered to Commonholders on 1-for-5 basis, record Nov. 26 to expire Dec. 9)	$1,434	22.00	7.27%
WEEK OF DECEMBER 11-17			
None			
SCHEDULE FOR DECEMBER-JANUARY			
Bonds			**Bid Date**
Kansas City Power & Light—1st mtg	$12,000		Jan. 20
Ohio Power—1st mtg	22,000		Jan. 20
Iowa-Illinois Gas & Electric—1st mtg	8,000		Jan. 27
Debentures			
Consolidated Gas, Electric Light & Power—conv. 3 1/4% 1967 (being offered to commonholders on basis of $100 debenture for each 30 shares of common, record Dec. 1 to expire Dec. 18)	$16,484	$100.00	3.25%
Preferred Stock			
Ohio Edison—150,000 sh $100 par	$15,000		Jan. 13
Ohio Power—100,000 sh $100 par	10,000		Jan. 20
Iowa-Illinois Gas & Electric—60,000 sh $100 par	6,000		Jan. 27
Common Stock			
Cleveland Electric Illuminating—557,895 sh (being offered commonholders on 1-for-5 basis, record Nov. 24 to expire Dec. 19)	$24,129	$43.25	6.01%
Southern California Edison—800,000 sh	...	...	Jan. 15
Ohio Edison—479,846 sh (to be offered to commonholders on 1-for-10 basis, record Jan. 8 to expire Jan. 23)	...	...	...
Consumers Power—617,669 sh (to be offered commonholders on 1-for-10 basis, record Jan. 15 to expire Jan. 30)	...	...	...
Southwestern Public Service—about 293,500 sh (to be offered to commonholders on 1-for-12 basis)	...	...	...
West Penn Electric—about 264,000 sh (to be offered commonholders on 1-for-15 basis record about Jan. 22 to expire about Feb. 9)	...	...	...
UNSCHEDULED AND UNDER CONSIDERATION			
Bonds			
Central Maine Power—1st general mtg	$6,000	...	...
Toledo Edison—1st mtg	7,500	...	...
Central Hudson Gas & Electric—1st mtg	6,000	...	...
Rockland Light & Power—1st mtg	5,500	...	...
Southwestern Public Service—1st mtg	12,000	...	...
Wisconsin Public Service—1st mtg	7,500*	...	...
Monongahela Power—1st mtg	10,000	...	...
Washington Water Power—1st mtg	10,000	...	...
Debentures			
Washington Water Power	14,000*	...	...
Preferred Stock			
Rockland Light & Power	5,500	...	...
Southwestern Public Service	2,000	...	...
Wisconsin Public Service	2,500*	...	...
Common Stock			
Central Maine Power	$5,000	...	...
Toledo Edison—500,000 sh	...	...	...

Notes—*Estimated.

CALENDAR

Edison Electric Institute
Accident Prevention Committee, Hotel Muehlebach, Kansas City, Mo., Jan. 12-13, 1953; Transmission - Distribution Committee, Shoreham Hotel, Washington, D. C., Feb. 12-13, 1953; Electrical Equipment Committee, Jefferson Hotel, St. Louis, Mo., Feb. 16-17, 1953.

Institute of Radio Engineers
Joint High Frequency Measurements Conference with AIEE, Statler Hotel, Washington, D. C., Jan. 14-16, 1953.

Canadian Electrical Association
Eastern Zone: Engineering Division, Nova Scotian Hotel, Halifax, N. S., Jan. 15-16, 1953; Sales Division, General Brock Hotel, Niagara Falls, Ont., Jan. 22-23, 1953; General Division, Mont Tremblant Lodge, Mont. Tremblant, Que., Jan. 29-30, 1953; Following Western Zone Division Meetings will be held at Palliser Hotel, Calgary, Alta.; Engineering, Feb. 23-25; General Division, Feb. 25-26; Sales Division, Feb. 26-27, 1953.

American Institute of Electrical Engineers
Winter General Meeting, Hotel Statler, New York, Jan. 19-23, 1953.

National Rural Electric Cooperative Association
11th Annual Meeting, Civic Auditorium, San Francisco, Jan. 26-29, 1953.

***National Association of Corrosion Engineers**
Short Course in Corrosion in cooperation with University of California, Berkeley, Feb. 2-6, 1953.

Missouri Valley Electric Association
Industrial-Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 5-6, 1953.

***National Adequate Wiring Conference**
La Salle Hotel, Chicago, Feb. 26-27, 1953.

***Pennsylvania Electric Association**
Winter Meeting, Transmission-Distribution Committee, William Penn Hotel, Pittsburgh, Feb. 12-13, 1953.

***Addition this week.**

REGULATION

Columbus, Ohio, City Council has approved $60,000 a year rate hike for the municipal plant . . . **Bangor Hydro-Electric Co** has received Maine PUC approval to increase domestic rates 9.4% or $190,000 a year . . . In Consolidated Gas Electric Light & Power of Baltimore rate case hearings, Clarence W. Miles, company attorney, has told the PSC that instead of asking for $6.4 million increase in electric rates, company now wants $3,850,000 by virtue of reduction in charges for energy purchased from Pennsylvania Water & Power Co . . . New York City's Board of Transportation has asked PUC to revise downward Consolidated Edison of New York's $2,782,800 a year rate hike for power to operate transit system's IND division. R. Frank Brower, assistant vice president in charge of planning, said Con Ed's schedule for transit system used "exactly the same rate per kwhr" PUC had ordered for other large users.

CONSULTING ENGINEERS: SARGENT & LUNDY

Waukegan Generator Advances Trend To Larger 3600 RPM Capacities

An important phase of the utility industry's drive towards greater power production economy has been the trend towards larger 3600 rpm generator sizes.

A significant advance was made at the Waukegan station of the Public Service Company of Northern Illinois in December, 1951, when a new turbine-driven generator, at that time the largest of its type, was put into service. This General Electric generator, rated 129,412 kva, 85% p.f. at ½ lb hydrogen pressure (or 148,824 kva, 81.3% p.f. at 25 lb hydrogen pressure), has turned in a trouble-free operating record, well within its performance guarantee. *

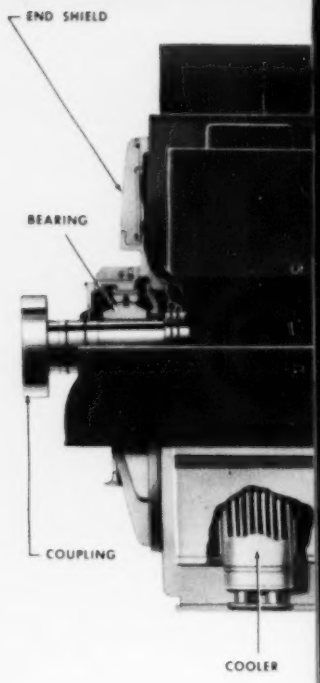
Because of its size and characteristics, the unit provides its owners with high efficiency at a relatively low capital investment per kilowatt capacity. For the electric utility industry, the Waukegan machine helps point the way towards higher pressure, higher-temperature reheat units, operating at high rotating speeds.

Despite its size, this machine does not mark a departure from General Electric's standard methods of design and manufacture. For example, a long established, service-tested system of ventilation was used. In fact, 96 additional generators of equal capacity or larger, employing standard design, are in various stages of manufacture.

** The generator is driven by a turbine with a nominal rating of 110,000 kw*

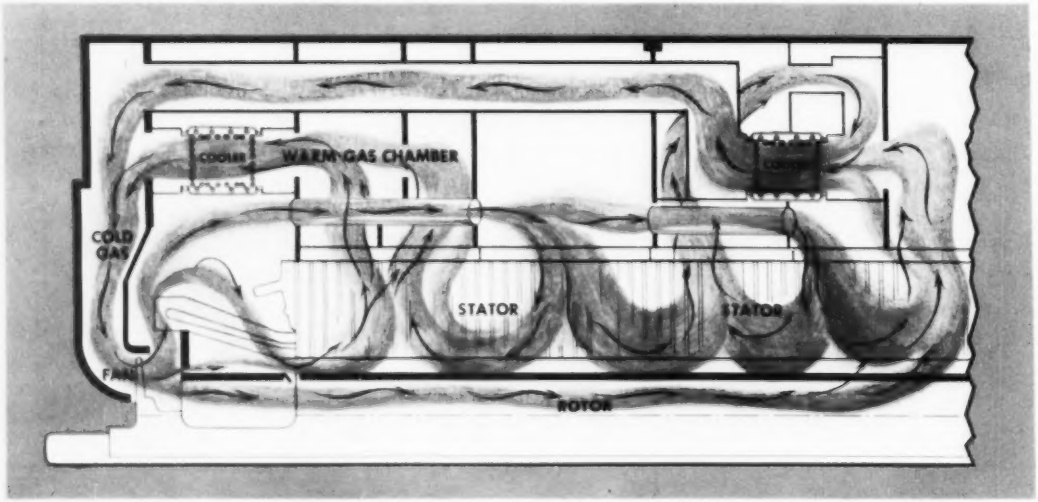
GENERAL ELECTRIC

FOR DETAILS TURN TO NEXT PAGE . . .

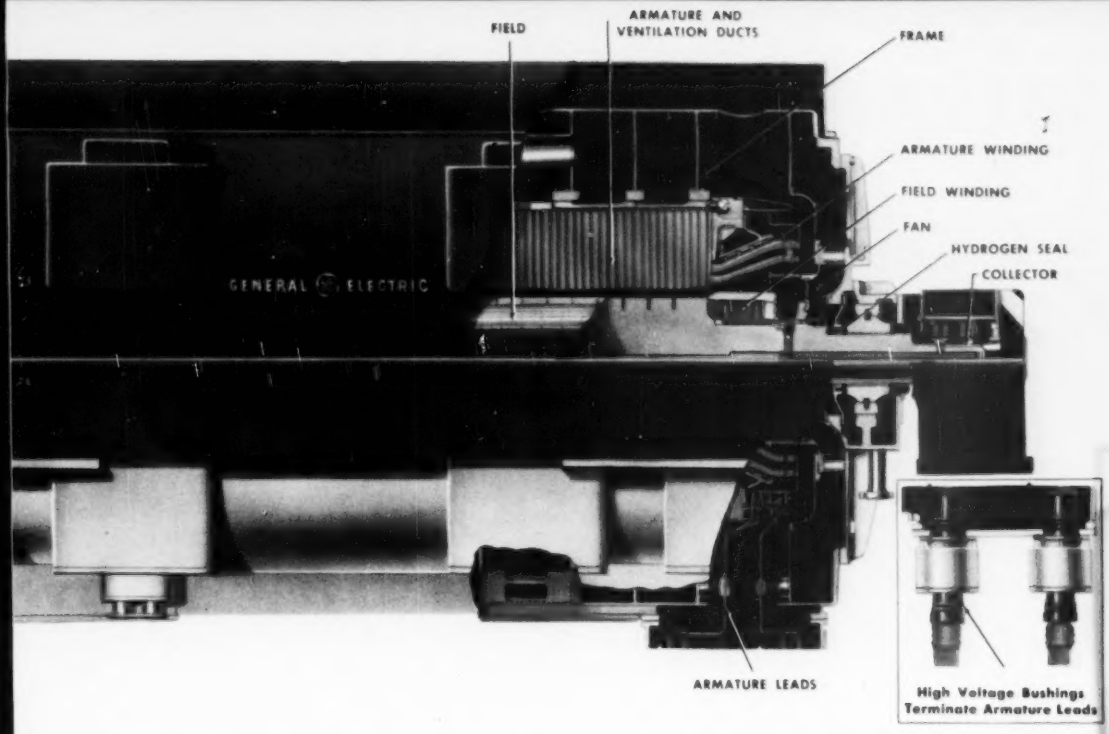


Leaders in General Electric's Turbine Division, shown checking a large generator stator, are C. E. Kilbourne, C. Schabtach, W. E. Saupe, and C. S. Coggeshall.

Proved Cooling Techniques Permit



Schematic drawing of a portion of the generator shows the path taken by the hydrogen gas as it cools the stator and rotor. Cool gas drawn in through the rotor fan is shown as blue; warmed gas as red.



Longitudinal section of the 148,824 kva generator at Public Service Company of Northern Illinois' Waukegan station. One-piece stator construction and standard ventilation system have been used in all large G-E 3600 rpm generators to date.

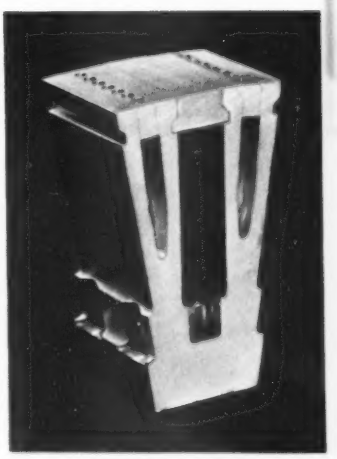
Advance in 3600 rpm Generator Sizes

In extending the rated capacity of 3600 rpm generators, one limiting factor is always ventilation. General Electric leadership in the development of hydrogen cooling has made possible a steady expansion of generator sizes.

Public Service Company of Northern Illinois' new Waukegan generator illustrates this progress. Although it was the world's largest 3600 rpm generator at the time of its installation, all of its features had been previously tested in commercial service in many power stations.

The cooling system embodies the most reliable techniques available. The field coil is practically surrounded with hydrogen ventilation to achieve a minimum temperature rise, together with improved uniformity in the radial distribution of temperatures through the turns of the field windings. Vertical coolers permit a simple, strong, light frame design.

The soundness of the design has been demonstrated by the record of the machine since it was put on the line. Temperature rise of the armature and field windings is substantially below guarantees which are in accordance with A.S.A. standards. Its smooth running, efficient performance is another achievement of General Electric's leadership in turbine-generator engineering and manufacturing.

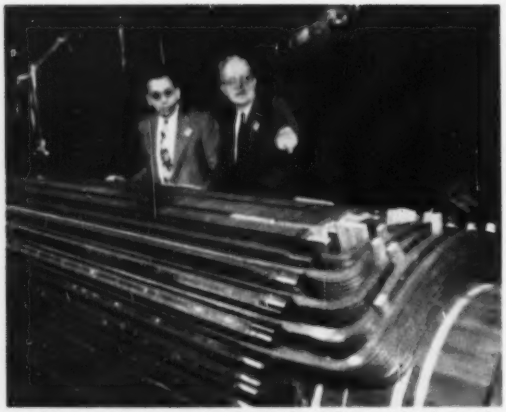


Model of field structure shows portion of one coil with its insulation, wedge, and two adjacent teeth. Three ventilation tunnels enable hydrogen to travel axially to the tooth ventilation holes.

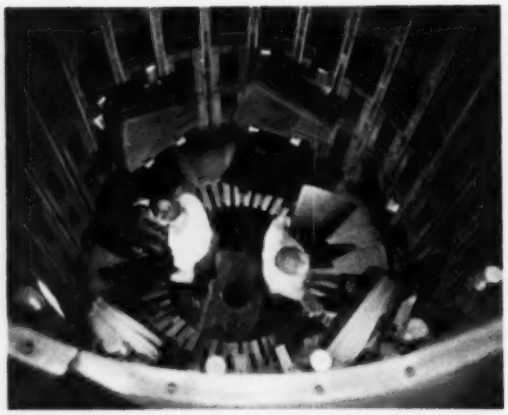
Leader in Turbine-Generator Progress

GENERAL ELECTRIC

new materials

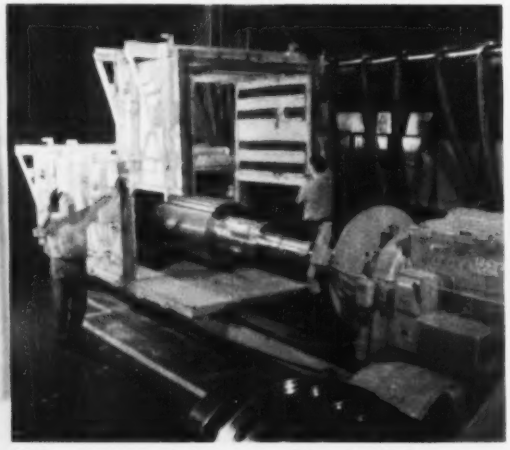


Condal, new aluminum alloy for field windings will solve problems of centrifugal stresses that previously limited rotor size.

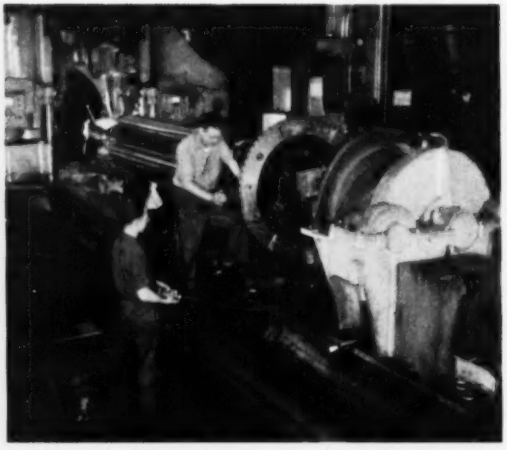


The introduction of oriented grain strip steel for generator laminations has reduced generator core losses, dimensions and weights.

new manufacturing methods and facilities



All large generator shafts are treated in a heat lathe to assure stability at operating temperatures. This treatment, along with precision balancing, has helped to lower average bearing vibration from $\frac{1}{2}$ mil to $\frac{1}{4}$ mil and average number of balance shots in the field from 7.0 to 1.5.



In this special milling machine, two opposite generator rotor slots are cut simultaneously. After each cut, the rotor is rotated so that adjacent slots will be milled by opposite cutters. This method helps preserve both mechanical and thermal balance and contributes to smooth operation of the generator.

support General Electric generator progress

Progress in generator engineering involves both the improvement of designs and the refinement of the materials and manufacturing techniques with which they are built. Several General Electric laboratories, working closely with material suppliers, continually test new materials for insulation, windings, rotors, etc. Tools in General Electric's turbine-generator plant are specifically designed to add to the precision with which these generators are machined and tested. If you would like more information on how General Electric builds turbine-generators, write for a copy of bulletin GED-1526, "Building a Power Maker." Section 254-1, General Electric Company, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

FIG 1—MAIN CONTROL PANEL of hipot test room, with water-filled gloves in position in test tank (left), milliammeter and reading glass above tank, test bus and plywood protecting panels at top. Operator is holding dead man's safety button to maintain voltage

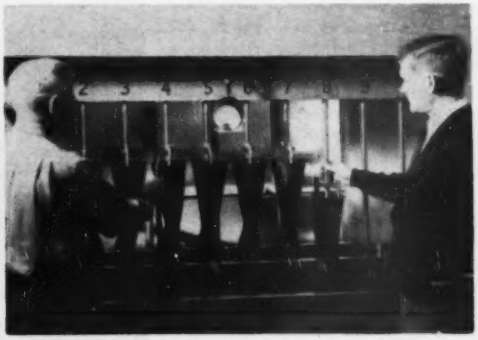


FIG 2—FILLING GLOVES is easily done with thumb-operated flexivalve and one-hand lowering operation. Plumbing and switching facilities (left), schematic connections (center), and nylon cord set-up (right) insure safe and convenient test techniques

Hipot Lab Highlights Safety Features

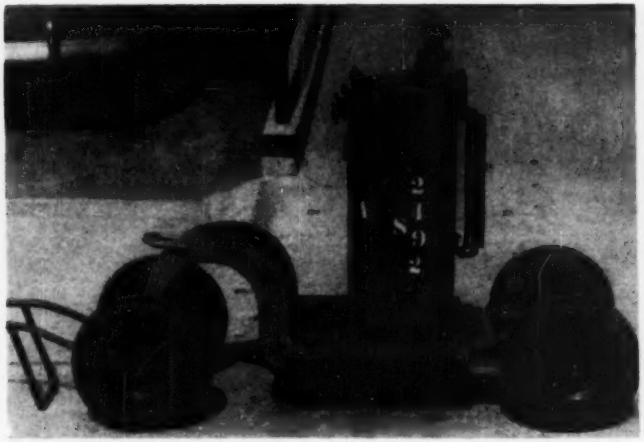
To enlarge an outgrown high-potential testing room and modernize rubber glove testing facilities, Hartford Electric Light Co laid out the new lab with a stainless steel tank accomodating ten 14-in. or 18-in. gloves in each run. The tank inlet is piped directly to the city water main, and the water level is maintained constant through six weep holes flowing into the drain trough.

After visual inspection, gloves are filled to an inch of the top from two rubber hoses fitted with gasoline station type flex valves. The gloves are lowered into the water, each hung on two wooden clothespins which were boiled more than one hour in paraffin. The pins are part of a bakelite block and brass tube assembly arranged from one-hand lowering.

The grounded tank forms one electrode, a line lead from the overhead test bus the other. For each glove a brass tube slides up and down in an outer brass sleeve and the electrical connection from the high-voltage bus is through this slide, no wires or chains involved. The gloves can be locked in the up position by bayonet slots on the brass sleeves, and a downward stop insures the same glove area is under test each time.

Unique Switching Scheme . . . Individual gloves are tested by pulling nylon fishing cords on a control console across the room. These cords operate a row of heavy duty SPDT toggle switches, spring-loaded in the open position. A 5-in. reading glass enables reading accurately on the 0-20 ma meter the milliamp leakage of each glove from across the room. A plywood panel protects the bus from a broken nylon cord.

Energy for testing is supplied by a 106-kv hipot transformer with protective sphere gap and current-limiting resistors. After test, the gloves are emptied into the tank or drain, and drained inverted while the next batch is fastened to the clothespins. The tested gloves are hung inverted on the



Cart Handles Transformers or Poles

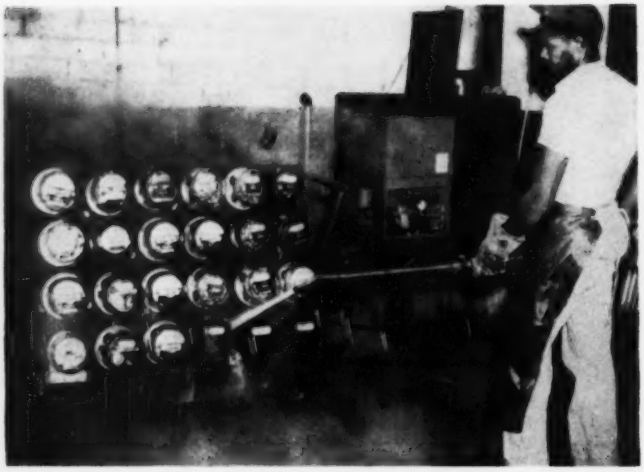
For getting transformers and poles to those hard-to-get-at places along rear lot lines a small rubber-tired cart has been made by the Oklahoma Gas & Electric Co. It reduces the manpower required for such jobs and prevents damage to lawns.

Several features add to its usefulness. Arched support at front permits cutting wheels for sharp turns. A steel bolster is added for carrying poles. It has a pin on the bottom that fits into the bed of the cart and is easy to put on or take off to make the cart suitable for handling either a pole or a transformer.

drying rack overnight. The rack's capacity is 340 gloves.

The nylon cords have been tested to a breakdown of 90 kv per ft. The doorway entering the test room has a safety gate with an electrical interlock cutting off the main line feeding the test set. The operator at the main control panel must push a "dead man's" control button all the time the set is alive, and the glove test man must push and hold a similar button on the remote wall to energize the set. A visitor's observation window 4 ft square is cut in the lab's wall. About 2,700 gloves are tested yearly.

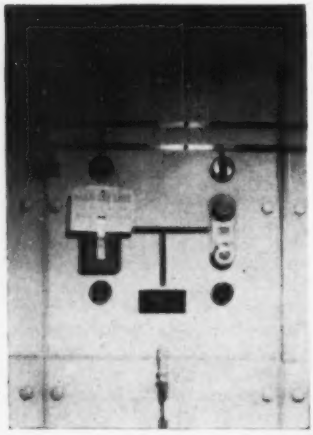
During any particular glove test, the potential is held at 10 kv for 3-min. Then the tester switches in the milliammeter, reads leakage.



Clean Meters with Steam and Detergent

Steam cleaning of meters brought in from the field saves considerable time and effort at El Paso Electric Co. Up to 90 meters can be cleaned at one time on a large meter buggy and up to 48 on a smaller unit. Cleaning of 48 fairly clean meters takes about five minutes, somewhat longer for meters liberally covered with all kinds of dirt, grease, and dust.

According to the company, cleaning with steam and a detergent does not affect the meters in any way. It is necessary only to play the steam jet on the glass covers for a minimum time to prevent cracking. After washing, meters are rinsed with clear water to remove all traces of detergent.



SWITCH HANDLE COVER prevents operation of switch by mistake, in spite of tag

Covers Prevent Operation Of Control Switches

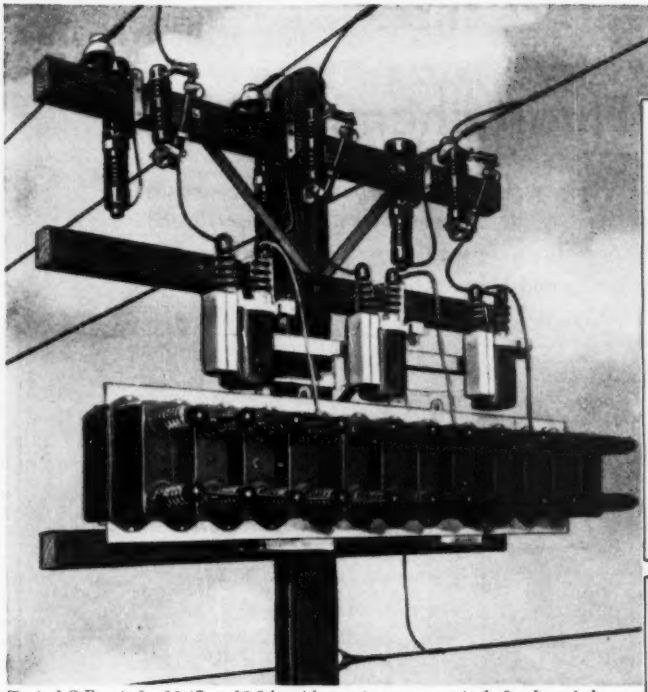
Plastic or wood covers on switch handles at control boards to prevent operation of switches by mistake are used by Pacific Gas and Electric Co. For a number of years, covers have been used when precautions are to be exercised in the operation of the switch or when a transmission circuit is out of service, even though suitable warning tags have been placed on the switch.

Covers are used on vertical and bench-type handles. However, the multiplicity of types and designs of switch handles precludes the use of a standard design.

Ebasco Services, Inc

Wire-Stringing Brake

This inexpensive brake for a wire stringing dolly has been developed by W. E. Snell, general foreman of linemen for City Light at Tacoma, Wash. It is made from the wheels of a Dodge command car pinned on a shaft squared at the opposite end to make a double lock. The reels of wire are bolted to plates welded on the shafts at the opposite end from the brake. Bull lines are used around the wheels, as they are on a "niggerhead," letting the ropes slip to let the wire pay out from the reels. When on a job where the stringing is difficult, an empty reel is used in front to provide two brakes on one wire. This brake also can be used for a simple take-up reel, if the strain is not too great, by using the niggerhead of a truck and an endless sling. Another brake is mounted on the dolly, but is hidden from view by the operator.



Typical G-E unit for 12.47 or 13.8 kv. 4-kv equipment uses single 3-pole switch.

G-E auto-switch equipment puts less strain and weight on pole

Side mounting of capacitors in General Electric auto-switch equipment brings the center of gravity of the equipment almost 50% closer to the pole than extended mounting. There's less strain on crossarms and poles. And because G-E capacitors are up to 25% lighter, the total weight on the pole is considerably reduced.

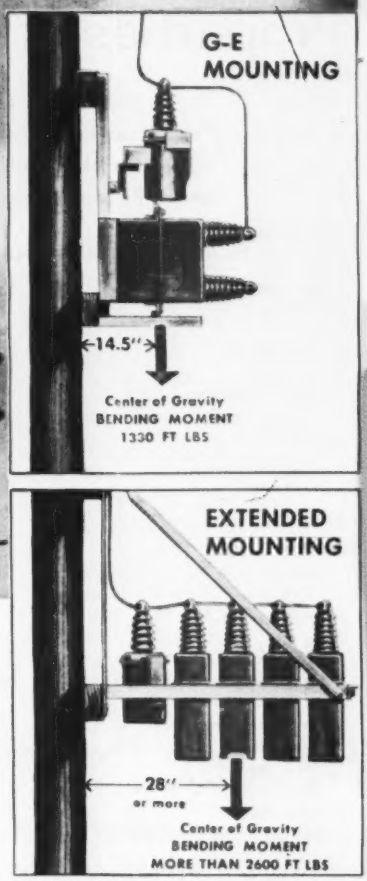
Neater, more compact design. G-E auto-switch capacitors—completely assembled, wired, and tested at the factory—arrive ready to install. All you do is hoist, bolt, and connect. Side mounting eliminates guy wires and extra braces—provides a neater, more compact appearance. Inspection and servicing are simplified.

Voltage regulating relay, the same as used in G-E regulator control to provide Class I accuracy, assures reliable control regardless of temperature or weather changes. Voltage and/or current-sensitive automatic controls are available. Controls, enclosed in separate weathertight housing for mounting at the base of the pole, are easy to inspect.

Available in 225 and 300-kvar ratings, from 2400 to 13,800 volts, this compact auto-switch equipment costs you no more. Get in touch with your nearest G-E Apparatus Sales Office for more information. General Electric Co., Schenectady 5, New York.

407-40

GENERAL ELECTRIC



LESS OVERHANG. Exclusive side mounting of G-E capacitors brings center of gravity almost 50% closer to pole, reduces bending moment, puts less strain on crossarms and poles.

ACCURATE CONTROL with famed voltage regulating relay. Weathertight housing mounts separately—permits easy inspection.

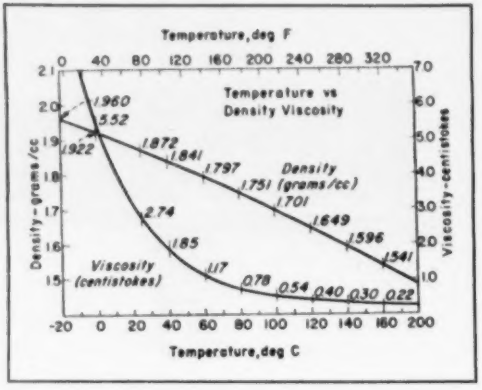
Properties of Fluorochemical N-43

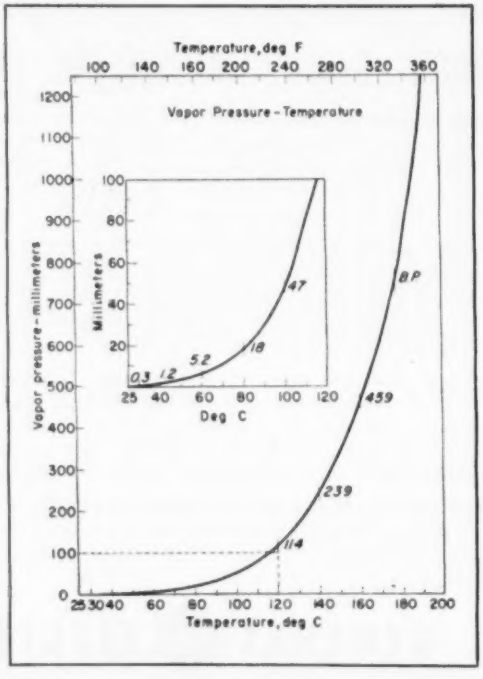
This inert fluorochemical liquid is a tertiary amine known as "heptacosafluorotributylamine." It is classed as a liquid dielectric and a heat transfer fluid. Accompanying preliminary data have been furnished by Minnesota Mining and Manufacturing Co.

Physical and Electrical Properties

Formula	$(C_4F_9)_3N$
Physical State at Room Temperature	Colorless liquid
Odor	Odorless
Formula Weight	671
Boiling Point	177 C (351 F)
Freezing Point (Glass Point)	−66 C (−87 F)
Pour Point	−50 C (−58 F)
Density*	
(g/cc at 25 C, 77 F)	1.872
Viscosity*	
(Centistokes at 29 C, 77 F)	2.74
Refractive Index (25 C, 77 F)	1.2910
Surface tension	
(dynes/cm at 25 C, 77 F)	16.1
Coefficient of Volume Expansion	
(per deg C) (25-40 C, 77-104 F)	1.2×10^{-3}
(140-160 C, 284-320 F)	2.1×10^{-3}
Specific Heat	
(cal/g/deg C at 25-40 C, 77-104 F)	0.27
Heat of Vaporization	
(cal/mole at b.p.)	11,100
(cal/g, BTU/lb)	16.5
Vapor Pressure*	
(mm Hg at 25 C, 77 F)	0.3
Trouton Ratio	24.6
Dielectric Strength (ASTM-D877)	40 kv
Dielectric Constant	
(100 cps at 25 C, 77 F)	1.86
Power Factor	
(100 cps at 25 C, 77 F)	< 0.0005
Volume-Resistivity	
(ohm-cm at 25 C, 77 F)	10^{15}-10^{16}

*See graph



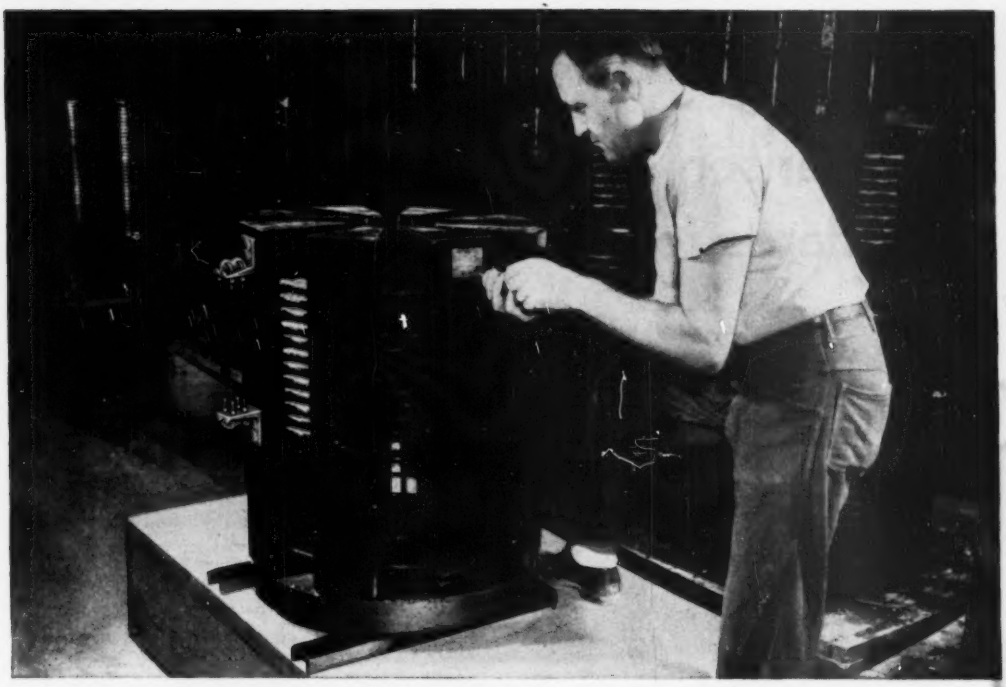


Fluorochemical N-43 is nonflammable and nonexplosive. It has thermal stability and can be heated in excess of 500 C (900 F) without evidence of decomposition. A slow reaction with water vapor takes place in the neighborhood of 400 C (750 F).

At ordinary temperatures (below its boiling point) this liquid does not react with strong acids, alkalies, oxidizing or reducing agents. Similarly, it will not attack or swell resinous or plastic materials or paper. Up to several hundred degrees C, metals of construction will not be attacked or corroded. Decomposition by arcs and sparks is resisted.

Toxicity: Nontoxic

Applications: Transformers, capacitors, contactors, relays, circuit breakers, high frequency equipment, instruments and meters.



Reactor shipments in 20 weeks with G-E "Repetitive Manufacture" reactors

New cast-in-concrete designs meet ASA standards C-57.16 for current-limiting reactors and AIEE-32 standards for neutral grounding devices

By applying "repetitive manufacture" techniques to its cast-in-concrete current-limiting reactors, General Electric can meet your need for faster reactor shipments. You can order RM reactors for delivery in 20 weeks—25 weeks if you desire metal enclosures.

The new RM reactors offer the same "extra service" features that have made G-E reactors industry's favorites for more than 35 years—features that give them almost unlimited life and reduce maintenance practically to zero.

Non-aging glass insulation. G-E reactors utilize glass insulation with its ability to withstand extremely high temperatures . . . its resistance to moisture . . . and its high electrical strength.

Continually transposed conductors assure more uniform current distribution. They minimize losses . . . increase short-circuit strength . . . make possible a smaller, more compact reactor.

RM reactor designs can be obtained in the 3 to 10 per cent reactance range, for 60-cycle circuits in EEI-NEMA recommended voltages up to 14.4 kv. Single-phase designs for both indoor and outdoor service; three-phase designs for indoor service only.

RM metal housings with provisions for cable entrance and exit can also be provided. These housings minimize stray currents and electric losses, and protect reactors against external damage.

For detailed information on the new RM reactor designs, write Section 422-1, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC

Comparison of American and British Standards for Oil Circuit Breakers

Table lists system conditions also short-circuit rating, performance, selection, testing and other important differences which exist between oil circuit breakers conforming to British Standards and American Standards Association

Item	British Standard	American Standard
System Conditions		
(a) Standard voltages over 5 kv	6.6 kv — 66 kv 11 kv — 110 kv 22 kv — 132 kv 33 kv — 165 kv 44 kv — 220 kv	5 kv — 69 kv 7.5 kv — 115 kv 15 kv — 138 kv 23 kv — 161 kv 34.5 kv — 230 kv 46 kv
(b) Standard frequency	50 cps	60 cps
(c) Standard short-circuit ratings	Sym Mva 25 50 75 100 150 250 350 500 750 1000 1500 2500	Asym Mva / Corresponding Sym Mva 25 / 20.4 50 / 40.8 100 / 81.5 150 / 122.5 250 / 204.0 500 / 408.0 1000 / 815.0 1500 / 1225.0 2500 / 2040.0 3500 / 2858.0 5000 / 4080.0
(d) Calculation of fault current	$I = \frac{E}{X}$ Where I = Fault current E = Phase volts X = Equivalent star reactance to the fault	$I = \frac{E}{X} \times \phi$ Where ϕ is determined thus:
		ϕ
		Speed of Breaker, cycles / Fault at Gen. v / Fault fed through Transformers
		8 — 1.1 — 1.0 5 — 1.2 — 1.1 3 — 1.3 — 1.2 2 — 1.5 — 1.4
Circuit-Breaker Ratings		
(a) Rated breaking-capacity	*Symmetrical* The rms value of the a-c component of that current which can be broken at a given voltage (i.e., I)	The rms value of the total current including d-c component which can be broken at any voltage (i.e., $1.225 \times I$) (assuming 50% d-c component)

Item	British Standard	American Standard
Circuit-Breaker Ratings (Continued)		
	Asymmetrical The rms value of the total current at a given voltage	
(b) Rated making current	Peak value of $2.55 \times I$ rms value of $1.51 \times I$	No values specified for either: Rated making current or rated latching current
(c) Rated short-time carrying current	No direct equivalent of momentary current but N.B. — rms value of making current is $1.51 \times I$ *1-sec current* Not less than maximum breaking-current (measured as average rms value over the whole period) *5-sec current* Not specified but must be stated	Momentary current = $1.6 \times I$ (1.4 in certain circumstances) *5-sec current* Not less than maximum breaking-current (measured as instantaneous rms value at end of first second)
Testing		
(a) Recovery voltage 3-phase	*Up to 500 Mva* Not less than 95% rated voltage *Above 500 Mva* Varies down to 30% at 1500 Mva (see BS 116, Part II)	Not less than 85% rated voltage (Most high capacity tests have to be supplemented by field tests)
(b) Recovery voltage 1-phase	$1.5 \times E$ subject to above easements	May be E
(c) Power-factor	*Up to 500 Mva* Not more than 0.15 *Above 500 Mva* Not more than 0.3	Not specified (But must be low to get asymmetrical conditions)
(d) Operating duty	B — 3 — MB — 3 — MB	CO — 15 sec — CO, oil-tight CB's CO — 2 — CO, non oil-tight CB's
(e) Test schedule	10% B — 3 — B — 3 — B 30% B — 3 — B — 3 — B 60% B — 3 — B — 3 — B 100% (sym) B — 3 — MB — 3 — MB 100% (asym) B — 3 — B — 3 — B Over-rating B — 3 — B — 3 — B	No specified schedule

Table is an adaptation from Publication No. 10 entitled "Comparison Between British and American Standards for the Short-Circuit Rating, Performance, Selection and Testing of Oil Circuit Breakers", issued by the Association of Short-Circuit Testing Authorities, Inc, London, W. C. 2, England.

NOTES

Sym (symmetrical) and asym (asymmetrical) are two quantities used to express the breaking-capacity of a circuit breaker. British specification requires both quantities to be proved, whereas American practice only requires proof of latter quantity.

For BS circuit breakers the information has been drawn from BS 116, Parts I and II, of 1937, which are based on IEC 56 of 1937.

For ASA circuit breakers the information has been drawn from ASA Publication C37.4-1945 through C37.9-1945 amplified by papers on the "Simplified Calculation of Fault Currents," published by the AIEE Committee on Protective Devices in October, 1942, and February, 1944. NEMA Publication 46-116, July, 1946, Part V, does not differ materially from the ASA specification.

Easy to Operate
DELTA-STAR'S
B-2P
High Capacity Switches for Outdoor Service
A slight pull on the hook ring releases the pressure and the switch is opened with surprising ease. Contact pressure is maintained without the use of cams, threads or other complicated clamping devices.
Available in standard voltage ratings from 7.5-kv. to 34.5-kv. and current ratings from 2000 through 3000 amperes.

High Electrical and Thermal Standards

to meet the requirements of present and future power systems are built into these switches. They are designed and tested to carry full rated load continuously and withstand short circuit current to their full short time ratings without damage.

Straight Line Current Path

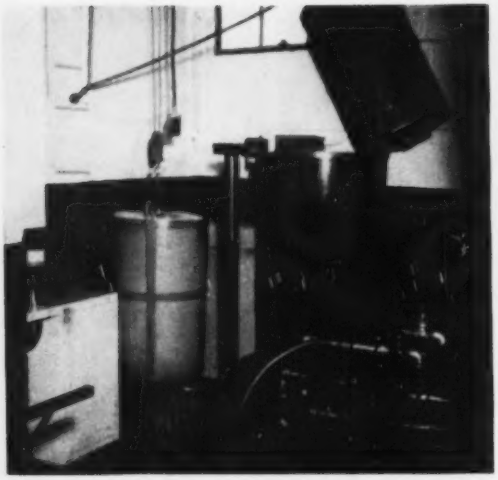
from terminal to terminal reduces to a minimum the number of current interchange surfaces. All current carrying parts are hard drawn copper with liberal cross section to provide ample material for heat dissipation. Individually sprung high pressure silver to silver contacts insure ideal contact.

For complete details, ask for Publication 5207

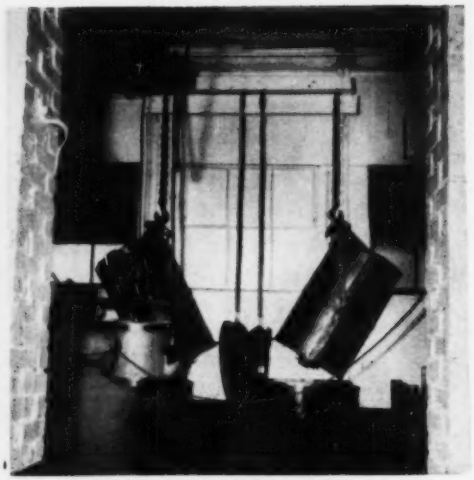
WHEN YOU WANT THE BEST IN HIGH VOLTAGE SWITCHING EQUIPMENT SPECIFY DELTA-STAR

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.
2437 FULTON STREET, CHICAGO 12, ILLINOIS
DISTRICT OFFICES IN PRINCIPAL CITIES



RAISING BASKET charged with fresh clay from storage room on lower level to purifier room directly above. Electric hoist lifts basket



LOWERING FRESH CHARGE into purifier. Rope moves crane trolley along overhead rail. Baskets at rear are draining

New Installation Reduces Clay Handling Costs

A. M. **McCABE** Substation & Val. Supt. Carolina Power & Light Co. Raleigh, N. C.

The Carolina Power & Light Co recently rearranged its insulating oil purifying equipment. Substantial reduction in clay handling and operating costs were made. Clay handling costs were reduced from 2.47 to 0.60 cents per gallon.

We are using two Honan-Crane purifiers of the 250 lb clay (Fuller's earth) size and one 10 gpm pump. Handling the fresh clay, assembling the bags in the baskets, filling these, and disposing of used clay, previously required an excessive amount of labor, regardless of where the equipment was set up, or how the oil was circulated. This prompted us to look into possibilities of reducing the operating costs. In addition to labor, it appeared that the most promising possibilities were in reducing the quantity of clay and the number of bags and felts used, and in reducing the amount of oil thrown away with the used clay.

After surveying available locations in and around the transformer shop and reviewing our experience with this equipment, the purifiers were put in a large drip pan at a place in the shop directly over a room where clay could be

DUMPING USED CLAY through outlet in floor. Attachment under operator's hand and circular plate in bottom of bag holds stem

CHUTE from purifier room conveys used clay outside, loads it into trailer which carries it to city dump

No. 8 IN A SERIES

a Sub-Station Engineer ASKS—

"what are the advantages of a larger second shell on the PINCO 735 switch and bus unit?"

here's the answer...

Prior to the introduction by Pinco of this improved, larger second shell design, all switch and bus units were susceptible to cascading in stacks, which of course was not desirable. Today, however, the Pinco 735 Switch and Bus Stacking Unit, with its larger second shell, improved center design and more rugged porcelain, shows far superior flashover performance and eliminates cascading. In addition, it also provides extra leakage protection and increased mechanical strength.

another PINCO "FIRST"

The design characteristics shown in the Pinco 735 have proven their superiority by *"right on the job"* performance in years of widely varied service in all voltages. The abilities and facilities responsible for this and other outstanding examples of Pinco pioneering leadership in insulator and special porcelain design and manufacture, are at your service. We invite you to—PUT IT UP TO PINCO!

• *See Page 118, Pinco Catalog No. 49 for complete electrical and mechanical specifications*

PINCO 735 SPECIFICATIONS

Dry Flashover	160,000 volts
Wet Flashover	95,000 volts
Leakage Distance	33"
Torsion Strength in lbs.	40,000
Tension Strength, lbs.	20,000

The Porcelain Insulator Corporation
LIMA, NEW YORK

PINCO INSULATORS

RIGHT ON THE JOB—

Sales Agents: JOSLYN MFG. & SUPPLY CO.
Offices in Principal Cities

clean penta* protected poles

build good community relations

When you treat your poles with PENTA, the *clean* wood preservative, you are building good public relations.

Clean full-length PENTA protection for poles and crossarms also reflects sound management since PENTA effectively lengthens wood life many times—cutting repair and maintenance costs to save you money!

More than 60 commercial treating plants can supply you with poles and crossarms treated with PENTA. A Dow technical representative is also available to you in solving your wood preserving problems. For *clean* protection, for positive protection . . . depend on PENTA!

THE DOW CHEMICAL COMPANY · *Midland, Michigan*

The Dow Chemical Company
Dpt. PE-15A, Midland, Michigan

- ☐ Send me free booklet "Pointers on Penta".
- ☐ Send me a list of Penta treating plants.
- ☐ Please have technical representative call.

Name _____ Title _____

Company _____

Address _____

City _____ State _____

DOW
*penta
CHLOROPHENOL

readily unloaded and stored. Openings large enough for the purifier baskets were cut in the floor at each end of the assembly and were fitted with hinged covers. A rail carrying a trolley and an electric hoist was installed over the purifiers and over the openings in the floor. Purifier baskets are filled with fresh clay in the clay storage room, pulled up through the floor by the hoist, moved along the trolley rail and lowered into the purifiers.

Baskets of used clay are lifted from the purifiers with the hoist and attached to chains that hang above and a little to one side of the purifiers. As the hoist is lowered the chains take the weight, and the baskets swing to one side, where they are left draining into the drip pan. An extra basket was purchased for each purifier, so one can drain while the other is in use. Draining for 24 hr releases all of the oil we have found economical to recover. We tried dumping the clay in water and letting the oil rise. This looked promising with fresh clay and good oil, but very little oil could be recovered in this manner from clay that was well saturated with impurities.

After the baskets of used clay drain, the hoist and trolley carry them to the other opening in the floor where the clay is dumped. We modified the Honan-Crane baskets so that they hold their bags and center stems in place when turned upside down, and the clay can now be dumped by opening the tops of the bags without removing the bags and stems from the baskets. We found that bags and felts can be used from three to five times, and we throw them away after every third charge. Washing in solvents for further use was found to be uneconomical.

The hole into which the used clay is dumped is fitted with a chute, through which the clay falls into a trailer parked outside the building. This trailer has two wheels patterned after the old fashioned one-horse dump carts. Its frame is elevated above the axle and the body is hinged at its balancing point to the rear of the frame. A pin at the front of the body holds it level. It can be readily knocked loose to dump the body. The body is oil tight to avoid dripping on city streets and carries about 40 cu ft of clay. Twice a week truck hauls clay to the city dump.

Roller-coaters 13.5 in. long apply paint to fence fabric and coverage is about 2.5 lineal feet greater per gallon than by brush method. Tarpaulin under fence catches paint drippings

Roller-Coater Used To Paint Fences

E. J. HIGGINS, Mechanical Engineering Division, American Gas & Electric Service Corp., New York, N. Y.

An improvement in fence-painting technique has been developed by using 13.5-in. long roller coaters equipped with extension handles. While field experience indicated that a satisfactory job can be done by the long-handle, janitor-type brush-painting technique, field trial has shown definite advantages for the following roller-coater technique.

Procedure . . . Steps in roller-coat painting are:

1. Rust on posts, railings and bayonets is removed by wire brushing. Two men on opposite sides of the fence remove loose rust from the fabric surfaces. They use 18-in. wire-centered horsehair brushes equipped with long handles.

2. Tarpaulin is placed between posts under the fence fabric to catch paint drippings.

3. Paint is mixed with approximately 30% of thinner by volume. About 1.5 gal are placed in two inclined containers, one on each side of the fence. The rollers are immersed in the paint and rolled back and forth on the inclined area to expel excess paint.

4. Paint is applied to the fence fabric, barbed wire and railings by two men working long-handled roller-coaters in a vertical direction on the fabric, and horizontally on the rails and barbed wire.

5. Excess paint drained onto the tarpaulins can be partially reclaimed by immersing the roller-coaters before the tarpaulin is moved.

6. Posts, bayonets and certain areas of the railings inaccessible to roller-coaters are spray-painted. In congested regions where overspray may be carried by wind and damage surrounding property, electrical equipment, insulators, or parked automobiles, paint is applied with oval sash brushes.

7. After the painting is completed, the roller covers are pressed to expel the absorbed paint and then immersed in varsol for cleaning.

Nature of Roller and Paint . . . Roller-coater covers are fabricated from synthetic lamb's wool which absorbs paint readily.

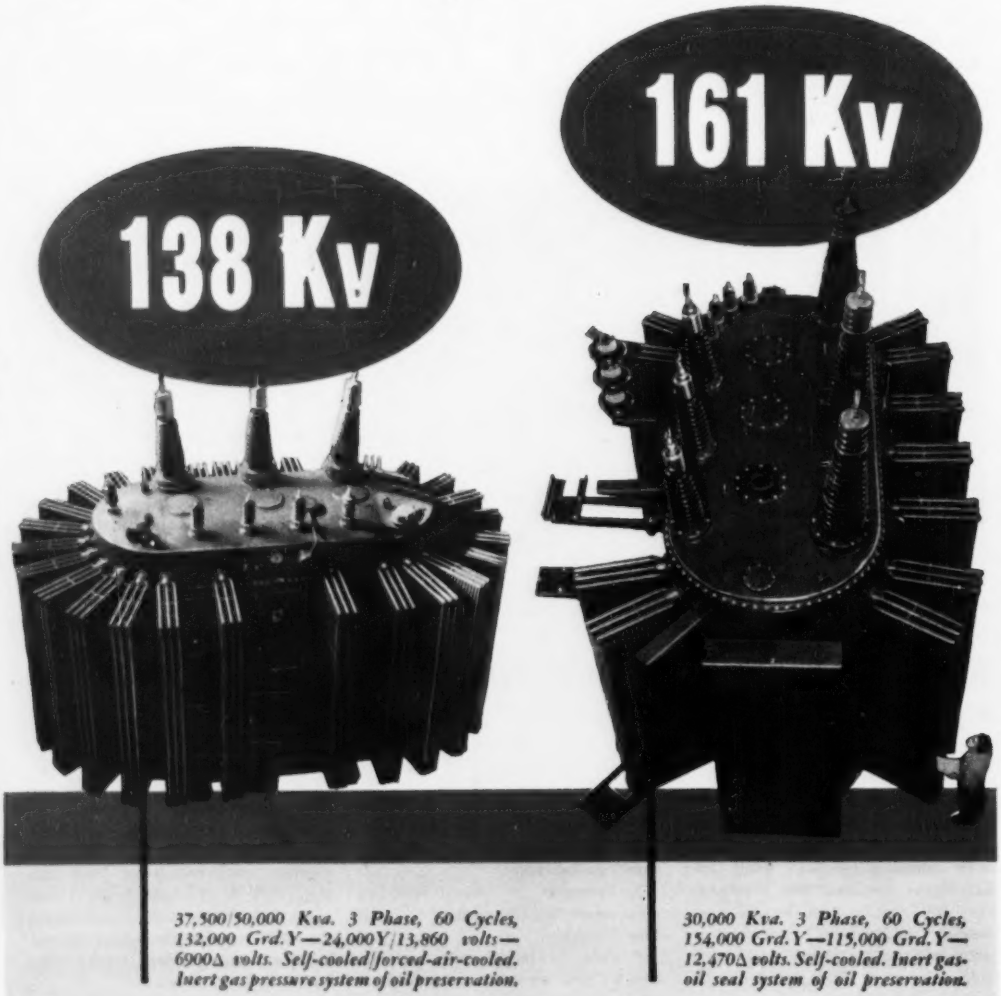
The paint, containing a multiple-pigment combination of lead and aluminum, is formulated for 1-coat work. It has been widely used during the past five years throughout the system for painting fences, transmission towers, structures, etc.

Example of Results . . . Recently a

(*Continued on page* 136)

High Voltage POWER

by Pennsylvania



37,500/50,000 Kva. 3 Phase, 60 Cycles, 132,000 Grd.Y—24,000Y/13,860 volts—6900Δ volts. Self-cooled/forced-air-cooled. Inert gas pressure system of oil preservation.

30,000 Kva. 3 Phase, 60 Cycles, 154,000 Grd.Y—115,000 Grd.Y—12,470Δ volts. Self-cooled. Inert gas-oil seal system of oil preservation.

TRANSFORMERS

Typical of the many higher voltage power transformers now under construction in the Pennsylvania plant are the recently-completed units pictured here. They represent single and three-phase transformers of core-form and shell-form construction.

Each transformer is designed and manufactured with the extra care and precision which will pay dividends to the user in the form of outstanding reliability and low operating costs.

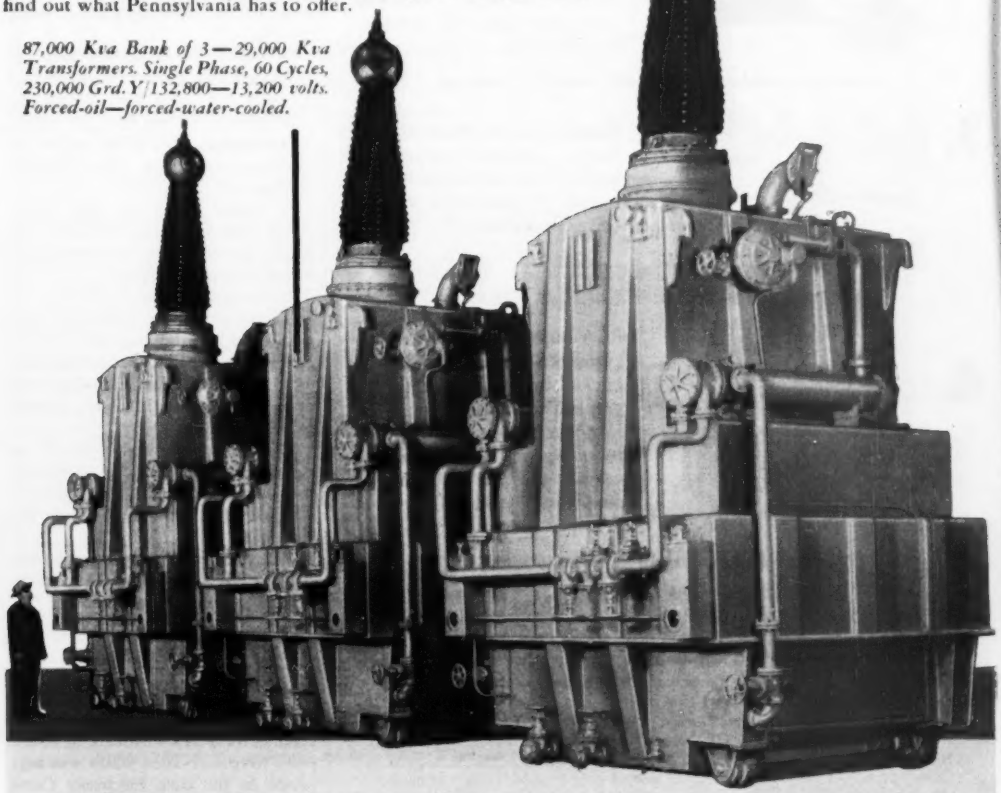
These units represent the growing acceptance and increased demand for Pennsylvania transformers. They are evidence of the confidence placed in the Pennsylvania product by the country's leading Utilities and Industrials.

This confidence is further emphasized by the fact that orders for 50,000, 60,000, 70,000, and 100,000 Kva transformers are now being filled at Pennsylvania's modern plant.

If your specifications call for high voltage power transformers, find out what Pennsylvania has to offer.

230 Kv

87,000 Kva Bank of 3—29,000 Kva Transformers. Single Phase, 60 Cycles, 230,000 Grd. Y/132,800—13,200 volts. Forced-oil—forced-water-cooled.



Pennsylvania TRANSFORMERS

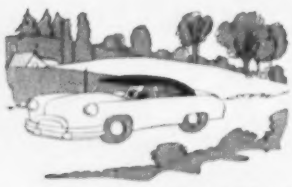
Pennsylvania TRANSFORMER COMPANY

CANONSBURG, PENNA. • *Greater Pittsburgh District*

Here's 4 reasons why—

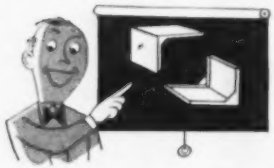
RCA is your best buy in 2-way radio

1.



Top performance in tough territory . . . razor-sharp reception in areas crowded with adjacent stations . . . where spurious signals may cause interference.

2.



Single-unit design for easy installation . . . case mounts on floor or wall of vehicle; right or left hand. Takes less space, provides easy access for servicing.

3.

Rugged construction for rough duty . . . vibration tested, shock tested. Treated to resist humidity, to operate in arctic or tropic weather.

4.

RCA-built, RCA-serviced for complete satisfaction . . . backed up by the world's greatest name in radio. Performance exceeds FCC requirements. Uses standard easy-to-get tubes. Continuing service provided by RCA Service Company if desired.

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Dept. 45L, RCA Engineering Products, Camden, New Jersey

Please send me my FREE copy of illustrated booklet on how RCA 2-way radio can help me in my business checked below:

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RCA **RADIO CORPORATION of AMERICA**
MOBILE COMMUNICATIONS CAMDEN, N.J.

Roller Coater Painting

(Continued from page 133)

field test using the roller-coater method of paint application was conducted at the Danville Substation of the Appalachian Electric Power Co on 324 lineal feet of fence. The results were:

	MAN-HOURS Total	per 100 ft
Cleaning (removal of rust and dirt along with some excavating between fence posts for placing tarpaulins)	14	4.33
Painting (includes mixing of paint and cleaning equipment after painting is completed)	21	6.5
Total man-hours	35	10.83

Application of paint with roller-coaters by two men required 12 man-hours; 5 man-hours additional were required for the spray-method finish-up job.

A total of 14 gal of thin paint (10 gal paint, 4 gal thinner) were required to paint 324 lineal feet, making the coverage 23.1 lineal feet per gallon.

Advantages . . . Roller-coater advantages over using 18-in. janitors' brushes are:

1. Weight of 13.5-in. roller-coater is less than 18-in. janitor's horse-hair brush, and results in less physical exertion by the applicators.

2. Coverage is approximately 2.5 lineal feet greater per gallon than with the janitor's brush method, showing less waste of paint due to drippings.

3. Barbed wire and accessible areas of railing can be satisfactorily painted by roller-coaters.

Definite information on the life of the roller covers is not available immediately. However, after painting 324 lineal feet no noticeable wear was apparent.

Roller-coaters equipped with long handles are available at $3.98 each; replacement covers cost $2.50.

New Preservative Treatment for Poles

Several important advantages are claimed for a new treatment of round poles for preservation which was suggested by the State Electricity Commission of Victoria, Australia, and elaborated by experts of the Forest Products Division, Australian Commonwealth Scientific & Industrial Organization.

Usually when power or other poles

Fast Motor Service Wherever You Are

ALLIS-CHALMERS "Certified" SERVICE

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Of course, Allis-Chalmers Certified Service Shops give good service on any electrical equipment, of any make. Tear out this ad and save it, or write the name of the A-C Certified Service Shop nearest you in your address book. Allis-Chalmers, Milwaukee 1, Wisconsin.

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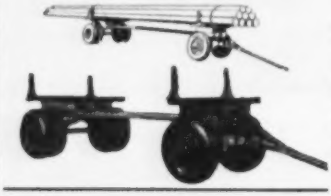
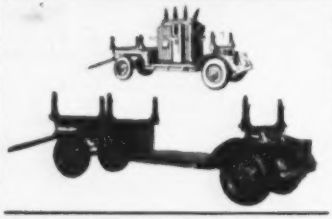
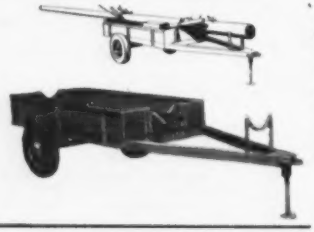


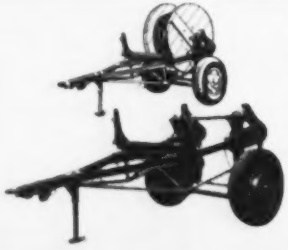
ADJUSTABLE LENGTH POLE TRAILER: easily adjusts to accommodate poles up to 90 ft. long — a big trailer that does a big job. Center pole telescopes. Trails smoothly. Equipped with electric brakes on rear wheels. Get complete information on Eagle Trailer Model 6450.



FOUR-WHEEL LO-BED TRAILER: for easy loading and hauling of heavy bulky units, also suited to pole and general purpose hauling. Five ton capacity, overall length 25 ft. 8 inches. Distance ground to low platform only 25½ inches. Equipped with electric brakes on rear wheels. Get complete information on Eagle Trailer Model 6441.



LIGHT-DUTY CARGO AND GENERAL PURPOSE TRAILER: light-duty, 1-ton capacity trailer for hauling one or two poles, cross-arms, pole hardware, etc. Has pole saddles front and rear and removable end boards. Get complete information on Eagle Trailer Model 7165.



COMBINATION CABLE REEL AND POLE TRAILER: complete with bolsters, stanchions, cable reel saddles. Quickly converted into a pole trailer by removing cable reel saddles and installing bolsters. A practical dual purpose unit, requiring only one trailer license. Get complete information on Eagle Trailer PCP — W-PCP series.

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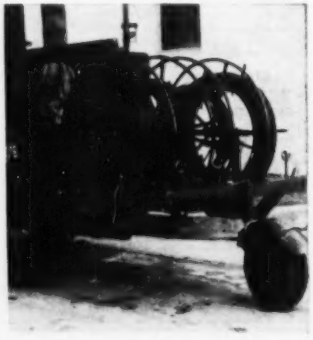
undergo preservative treatment in the hot and cold bath, using creosote, the butts only are immersed in the bath because the high loading of preservative obtained is not needed in that part of the sapwood above the ground. Such treatment is difficult, especially when proper lifting gear is not easily available.

Poles may be laid horizontally and the butts sprayed with hot preservative until they are considered to be thoroughly heated. The heat is then turned off and the spray continued until they have cooled.

Successful tests have been conducted on a specially constructed simple plant. The preservative was heated by electric elements in the tank and continuously circulated by the pump over the butt of the pole which is inserted in the treating cylinder. With this plant, preservative penetrations and retention very similar to those obtained in the hot and cold bath have been obtained. Compared with the hot and cold bath, much less preservative is used. This fact as well as the portability of the plant suggest its use for the treatment of poles at or near the site of installation.



FOUR DIFFERENT CONDUCTORS are carried on simple trailer to eliminate juggling of loose coils at each new location. Reels carry covered aluminum and copper wire in sizes Nos. 4 and 6.

Cut Service Installation Time with Reel Trailer

C. G. DAHLGREN, General Foreman, Electric Light Dept, Riverside, Calif.

Savings in time and effort are provided through a four-reel trailer which carries covered wire for installing serv-

(*Continued on page* 143)

HI-TENSION NEWS *Junior*

A. G. & E. Applies Standard O-B Components to 330-KV Construction

● Conception and construction of a huge 330-kv trunk transmission line, interconnecting many points of economical generation with centers of great demand, is such a major advancement in American power facilities that the project itself may overshadow some of its significant details . . . On this line, the first of its kind in the U. S., Appalachian Electric Power Company, a subsidiary of American Gas & Electric Co., has adapted service-tested components and practices to a project radically new in size and voltage . . . . Since O-B was privileged to participate in both the early research as well as the actual construction of this line, it is a matter of interest that regular 15,000 and 25,000-pound O-B insulators were used. Likewise, O-B Cooline suspension clamps, embodying standard design, were employed. The use of a simple corona shield made possible this conventional, economical hardware practice . . . . Illustrated here is one of the 18-unit O-B suspension strings being clipped-in, along with a Cooline clamp and O-B shield - - thus applying proven standard practices to a new conception of power transmission.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

In a mountain meadow of the Far West stands this frame-mounted 69 kv Pacific Electric oil circuit breaker, one of five of this type recently installed at this substation by a prominent utility. According to its builder . . . "the breaker is electrically and mechanically trip-free in any position, and reclosing is always from fully open position thereby assuring maximum interior insulation during the critical surge time that follows an interruption caused by repetitive lightning. Other Pacific features include low operating current (not exceeding 12 amp at 125 v d-c), fast and simple latching, sliding shoe (finger) contacts in nested sets of four," . . . AND . . .

O-B BUSHINGS

One of the Finest Components of Any Circuit Breaker

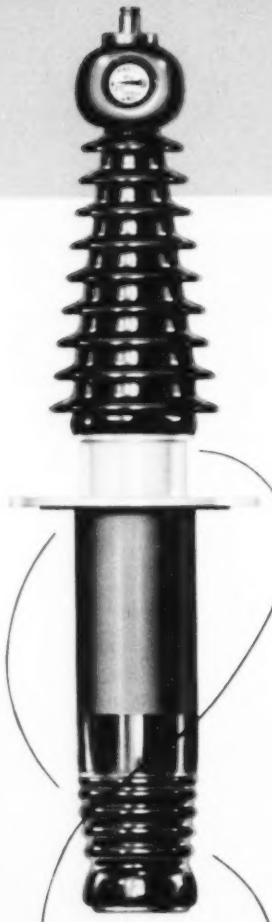


FIGURE 1

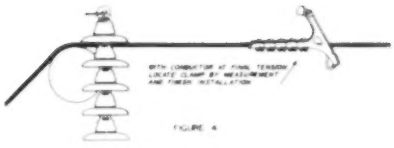


FIGURE 4

FIGURE 2

FIGURE 5

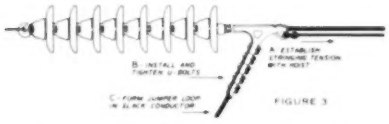


FIGURE 3

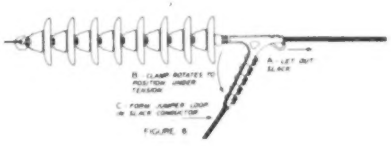


FIGURE 6

Figures 1, 2, and 3 -- Method of installing Hi-Lite clamp by use of stringing eye.

Figures 4, 5, and 6 -- Method of installing Hi-Lite clamp by utilizing conductor tension.

IT'S EASIER TO BUILD UNCUT JUMPERS ...AND A WHOLE LOT BETTER!

When you build transmission line jumper loops at strain points, don't cut the conductor! Satisfactory splices at these points are rare. It takes longer to build spliced jumpers, costs more, and all you get for your effort is trouble.

O-B Hi-Lite strain clamps, either in malleable iron or non-magnetic Cooline type, attach to the continuous conductor cable with an easily-made and easily-inspected bolted connection. They will develop adequate slipless holding power with big safety factors. They permit you to check this condition any time in their life. Inherently low in cost, they save construction time and produce trouble-free continuous jumpers. Two alternate ways of installing Hi-Lite clamps are shown here, in order to illustrate their simplicity.

Specify O-B Hi-Lites on your next transmission project and build trouble *out* of the system!

Ohio Brass

MANSFIELD, OHIO, U.S.A.

HI-TENSION NEWS *Junior*

How to Get More Than Five Year's Use From This Insulator!

GraybaR QUALITY Since 1869 — *Distributed by* GraybaR ELECTRIC COMPANY

If we told you that an O-B six-inch suspension insulator might not last five years, you would rate it as a poor buy - - but this can be exactly the case. A primary deadend, built today with one six-inch unit, for operation up to 4,000 volts, may serve adequately. But, residential demand has risen 300 per cent in only ten years, and it may double again in the next five, according to many authorities. Will 4,000 volts supply this demand? If not, the deadend must be rebuilt, because it didn't last five years!

Suspension insulators, as a mechanical device, are indefinitely durable. The same can't be said, however, about the plans on which their use is based. If you want reasonable service from primary deadends, build them just once instead of *twice* - - build them with *two* insulator units that will handle 12,000 volts without further attention or expense. It will save you money in the end.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

4232 H

Four-Reel Trailer

(*Continued from page* 138)

ices on the system of Riverside Electric Light Dept. Trailer holds coils of No. 4 and 6 wire, both aluminum and copper, in position for convenient withdrawal and eliminates juggling of loose coils to get the right conductor at each location.

Trailer frame consists of channel iron sections welded together. An A-frame in the middle of the trailer supports the reel bar in the center, while steel straps on the trailer sides support the ends of the bar. However, straps are bolted to the frame to allow two reels to be placed or removed from each end of the bar.

Reels made from ½-in. conduit consist of an outer ring attached to five spokes welded to a hub, and an L-shaped arm welded to each spoke. Reels are braked by spring tension to keep them from unwinding more than necessary. Conductor guides in front of each reel assist in paying out wire over a wide angle behind the trailer. Guides are formed of a metal bar looped upon itself and welded to the trailer frame.

Steps and a platform on the trailer allow linemen to get in and out of the truck readily. The trailer attaches to trailer hitches welded to the frame of the truck. Single trailer wheel is kept under tension by a coil spring to eliminate wobbling during transit.

TEST LEAD ROLL used by Idaho Power Co relay testers is easy to carry, permits convenient selection of leads, and keeps leads from getting lost. Roll has 13 zippered pockets, with stencilled information above each to identify type of terminal on lead and length of conductor. When rolled into a bundle, kit may be bound and carried by a strap.

for true economy in street light control

THE FISHER-PIERCE PHOTOELECTRIC CONTROL

• LOW INITIAL COST
• LOW INSTALLATION COST
• LOW MAINTENANCE COST

The *cost* of control of street lighting includes more than just the price of the control itself. Cost of installation is another major factor. Maintenance costs, if too great, can overcome all other economies.

The F-P Series 63300B Control combines *all three* elements of economy. No control of similar specifications has as low a purchase price. None requires fewer man hours for installation. No other control has equalled the F-P record for maintenance economy.

Fisher-Pierce is able to provide this economy in street lighting control because of its years of experience and its extensive engineering organization. Fisher-Pierce Controls have been proven by the experience of over 700 utilities now using more than 35,000 Fisher-Pierce units.

If you are considering adding to or modernizing your street lighting, be sure to investigate the possibilities of Fisher-Pierce photoelectric controls.

Write for Bulletin 63300B.

The FISHER-PIERCE CO., Inc.
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GLARELESS HIGH LEVEL light with new fluorescent floodlights assures safe and efficient operation on airport apron. Uniform distribution is produced at relatively low mounting heights.

FLOODLIGHT UNITS spaced on 25 ft centers are bracketed to rail of observation deck.

Fluorescent Floodlights Solve Airport Apron Lighting Problem

H. N. McINTYRE, Illuminating Laboratory, General Electric Co, W. Lynn, Massachusetts

A recently completed installation of fluorescent apron floodlighting at Logan (Boston, Mass.) International Airport provides high-level, glare-free illumination.

The light is more uniformly distributed and equipment is more economical to operate than that obtainable with any other type of lighting. Servicing is speeded and turn-around time decreased. Maintenance of aircraft is much more efficient and less expensive to the airlines. Safety is increased for passengers, pilots and crews.

At Logan, every attempt was made to improve conventional filament lamp floodlights through use of special lenses, louvres, and visors. This reduced glare, but also reduced uniformity of illumination below acceptable limits. Conversely, the fluorescent luminaires, which replace a portion of the original installation, provide excellent uniformity and lack of glare. The difference between the illumination provided by these fluorescent "floodlights" and that furnished by the conventional floodlights is quite noticeable. Viewing the installation from the air, or from the runway as the aircraft is taxiing in toward the terminal, there is considerable contrast between other portions of the ramp which are lighted. Yet this is done with no objectionable glare into the eyes of the pilot.

Compared to the amount of light which can be seen on horizontal and vertical surfaces in front of the new installation, the luminaire reflecting surfaces themselves are relatively dim. This feature is obviously one great advantage of fluorescent floodlighting over conventional equipment: it makes possible high light output with low source brightness.

This advantage means that very low mounting heights and flat angles of projection can be employed without noticeable glare. Conventional small-source floodlights mounted so low often prove uncomfortable, even disabling to a dark-adapted pilot taxiing into an apron.

The lower mounting height made practical by the fluorescent floodlight increases direct illumination of objects seen from the ramp side; flat angles of projection improve silhouette effect as observed from the runway side of the apron.

Low mounting has very little effect on the degree of uniformity produced by fluorescent floodlighting. Low-mounted conventional floodlights, however, provide poor uniformity of illumination. Hot spots and dark areas inevitably result, along with more or less disabling glare.

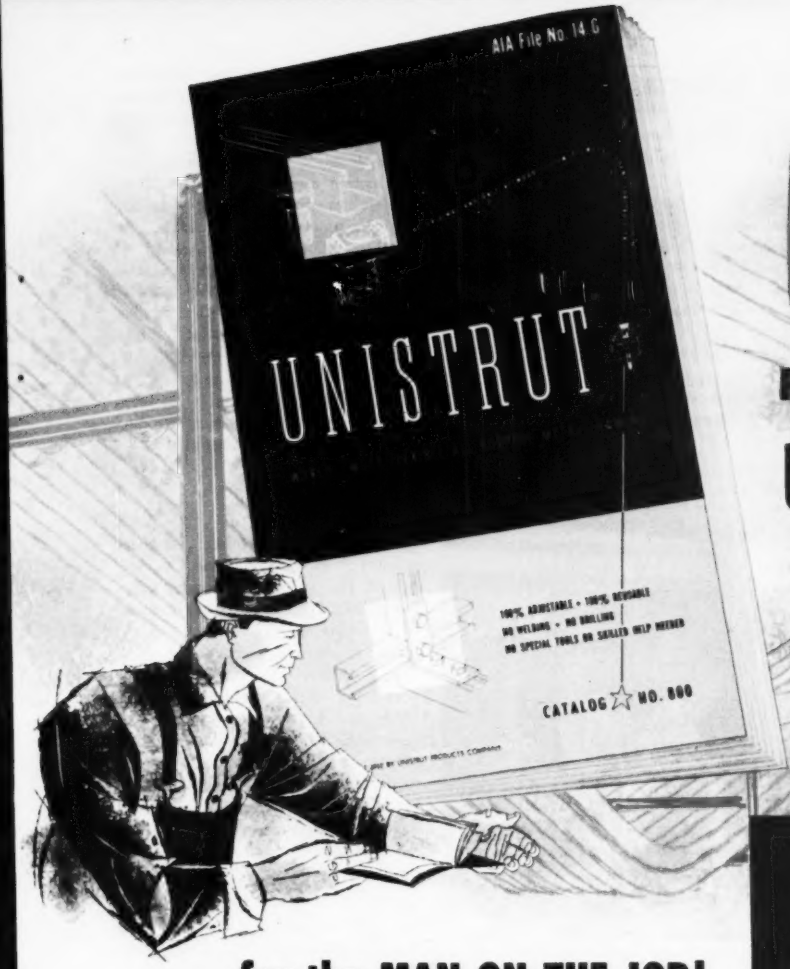
Each of these fluorescent floodlight units contains two 8-ft Slimline fluorescent lamps operated at 600 ma. Total available light at each luminaire is over 10,000 lumens.

A total of eight fluorescent floodlights are bracketed to the hand rail which borders the observation deck looking toward the runways. This places them 2 ft above the roof edge, for a total mounting height of 17 ft. Positioned co-linearly, the floodlights are spaced about 25 ft from center to center.

This installation illuminates an area approximately 150 ft wide by 200 ft long to an average initial level of 1.0 lumen per sq ft. Yet the power consumption is less than that of the two 750-w conventional floodlights previously employed to light this area.

From the standpoint of horizontal illumination, uniformity is unsurpassed. Moving away from the floodlights toward the runways, the illumination level falls off uniformly from about 4.88 lumens per sq ft 12 ft from the floodlights to .03-.04 ft-c at 175 ft. Lateral uniformity, that is, uniformity along lines parallel to the floodlighting installations, simply does not vary at all until the end floodlights are reached.

Vertical levels are from 1½ to 10 times as high. Maintenance can be



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performed without difficulty in this area, and no auxiliary sources of light need be employed. The area is unusually free of shadows.

Jack Woods, Operations Manager of American Airlines, says "the new fluorescents provide uniformly distributed, practically glare-free light. Pilots, loading crews and passengers say the fluorescents are far more comfortable on the eyes than conventional incandescent floodlights.

"In view of the heavy night traffic, our loading ramp requires high vertical light levels. The fluorescent floodlights facilitate and speed maintenance and loading between flights."

INDUSTRIAL BRIEFS

Relief annealing at Automatic Machine Products Co., Attleboro, Mass, with pot type furnace (with fan) relieves stresses in brass ammunition components. Temperature control is accurate and there is no contamination of metal. Shop is much cleaner. Furnace is rated 60 kw, 208 v, 3 phase. Two loadings of between 3500 and 4000 lb per load are annealed each night with furnace operating at 550 F. George B. Newton, Power Sales Eng. Attleboro Steam and Electric Co, Attleboro, Mass.

Alloy melting with electric furnace has replaced oil heat at Holmes Electrotype, Inc, Worcester, Mass. Formerly, an employee had to visit plant early in morning to warm up furnace for production when force arrived. Thermostat control and time clock switching give topnotch service. Danger of lead oxidation from overheating no longer exists. Comfortable operation is on daytime schedule, five days a week. Furnace has 18-950-w tubular, immersion, 220-v horizontal units. Three of these have been added recently to insure better maintenance of 650 to 700-F. Furnace is 24-in. x 30-in. x 6-in. deep. Maximum production of lead, tin and antimony alloys is 1,400 lb per day.

Automatic welding of "Q" panel spacers with two 160-kva, 3-phase welders at H. H. Robertson Co, Ambridge, Pa., speeds production, keeps power factor high and power demand to a minimum. Greater welding capacity is obtained from power facilities. Skilled operators are not necessary. After welding cycle is established to meet requirements of type metal fabricated (stainless steel, aluminum, galvanized steel, or black steel) welding of panel parts is entirely automatic. Operator merely presses foot pedal to start welding. E. M. Wenner, Industrial Power Engineer, Duquesne Light Co, Pittsburgh, Pa.

Constant temperature the year round —a very important item in a manufacturing process, is provided in an industrial plant by a heat pump installation. Cost of air-to-air heat pump installation was $28,725 compared with an estimated $31,000 for a conventional heating plant and air conditioning system, according to Gil Freyder, Commonwealth Edison Co., in talk before recent Chicago's Electrical Modernization Conference.

Freyder also described 18 installations where heat pumps are heating water on a test basis. Wattage is only 840 as compared to 2,500-w inconventional water heater. For this reason no off-peak control is required. Cost would be perhaps $100 higher than that for a conventional electric water heater but operating cost, based on the 18 test installations, would be $2.56 per month compared to $4.30 per month for the same amount of water heated to same temperature with a conventional water heater.

DRYING VARNISH on mica strips in electric tunnel conveyor oven increases production with reduced labor and fewer rejects compared with formerly-used batch type oven

Electric Drying Tunnel Increases Mica Production

A. C. SUTTON, Industrial Power Sales Engineer, Carolina Power & Light Co, Asheville, N. C.

An electrically-heated tunnel type oven has increased production of varnished mica coil insulation strips with reduced manhours and rejects at the Spruce Pine Mica Co, Spruce Pine, N. C. 70,000 units are now produced weekly with 11 employees—compared to 50,000 units with 13 employees using the old batch-type oven. Rejects have been cut to less than 1% compared to better than 10% in the batch-type oven.

The silicone varnish is cured by air drying and heating. Air drying of the silicone coating prior to the application of heat is essential, to forestall blistering. The tunnel has two detachable link chain conveyors, to provide 30 min of air drying through 45 ft of travel before entering the heated section of the tunnel. The heated section provides 20 min of drying at 450 F. Interior dimensions are approximately 2 ft by 1 ft and the heated end of the tunnel is covered with 3 in. of rock wool insulation. Eleven ,1500-w strip units mounted in the bottom of the section are thermostatically controlled.

This installation has been in service for more than a year and the management reports complete satisfaction in its operation.

6 BIG REASONS WHY VICTOR PURIFIED PORCELAIN SWITCH and BUS INSULATORS ARE BETTER!

VICTOR NO. 742 (NEMA TR-No. 7). For complete engineering data on all Victor Switch and Bus Insulators, send for Bulletin No. 5.

1. Improved thermal resistance. Purified Porcelain, pure porcelain all the way through, expands and contracts more uniformly during sudden temperature changes.
2. Unmatched porcelain hardness and density, resulting in rock-like strength.
3. Higher average puncture values.
4. Better tension, torsion, cantilever and impact values.
5. Smoother, harder glaze with unequalled self-cleaning characteristics.
6. Finest insulator porcelain ever made—uniformity of quality never before achieved!

Specify VICTOR SWITCH and BUS INSULATORS

VICTOR INSULATORS, INC., VICTOR, N.Y.

FLEXIBILITY of store lighting makes display changes easy. Visual front attracts and holds attention, according to J. R. King, Jr., store owner

Swivel Downlights Solve Decorator's Lighting Problem

JOE W. PARRIS, Advertising Dept., Georgia Power Co, Atlanta, Ga.

A flexible lighting system producing a non-uniform distribution of light helped to solve the problem of lighting an interior decorator's display rooms. James R. King, Jr., owner of Jimmy King Interiors, Macon, Ga. apparently a perfectionist in lighting, desired custom lighting when his new building was being designed.

An even, uniform light is not desirable in the display rooms of an interior decorator. The entire stock (model residential interiors, home furnishings, tapestry and drapery) is subject to continual shifting and repositioning. The lighting is therefore required to be sufficiently flexible to highlight any area or spot at any time. This part of the problem was solved by the use of swivel downlights. The display area contains 12 2-150-w adjustable units, 18 1-150-w recessed units, 10 1-75-w recessed units and one crystal chandelier.

The adjustable units are spaced in three rows and are on 4-ft centers. Units of 150-w are on 8-ft centers and 75-w units on 5-ft centers.

Footcandle illumination, measured shortly after installation was completed, read as follows:

Window—150 ft-c
Display area—15 ft-c (average)
Featured displays—150 ft-c
Show cases—60 ft-c
Work room—40 ft-c

UNIFORM LIGHT is *not* desirable in display rooms of interior decorator. Swivel downlights and recessed units solve problem of highlighting any given spot or area.

The showcases call for individual lighting treatment. Since they usually contain the kind of merchandise that looks best when placed under a concentrated light source, reflector type spotlights are used in the overhead adjustable fixtures and are focused on the showcase.

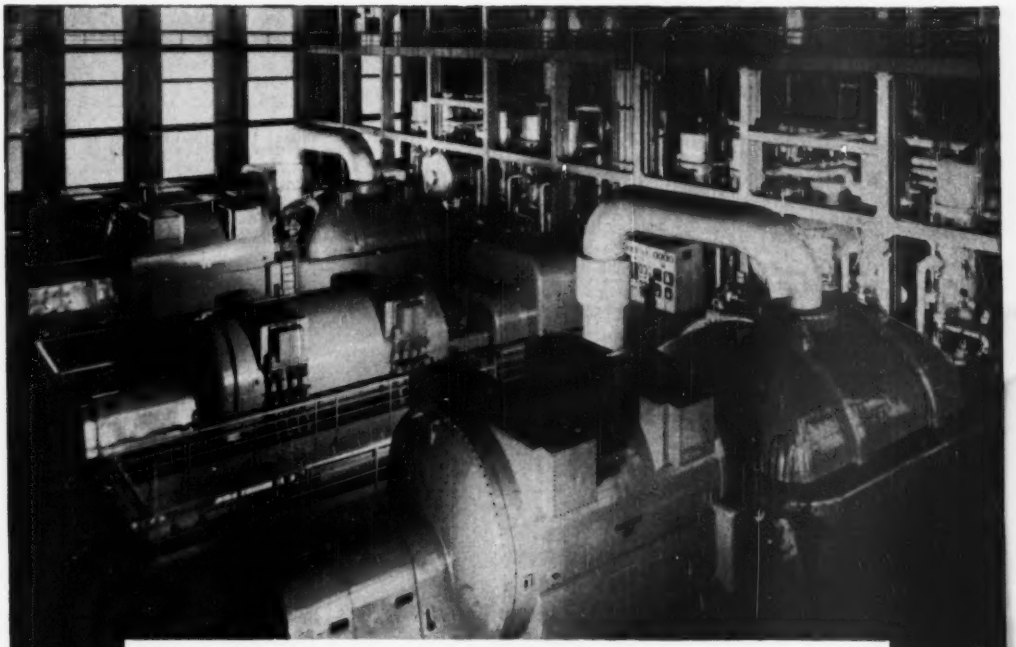
Window lighting has been arranged in three separate rows with five possible levels of illumination. Owner King did his own interior decorating for the building. The lighting design was made by James O. Rittenhouse, Georgia Power Co lighting engineer.

Union Electric Sponsors Town Betterment Contest

A "Planned Progress Program" to interest high school students and their parents in town improvement projects has been launched in its service area by Union Electric Co of Missouri.

In the first phase of the program, now in progress, teams of teen-agers are preparing to submit recommendations on how to make their home towns better places in which to live. For the best report the utility will

Typical of the outstanding steam turbine generators lubricated with Gulfcrest Oil are these two 168,750 kw. Westinghouse Cross-Compound turbines at the Southwark Electric Generating Station of the Philadelphia Electric Company.



GULFCREST is the RIGHT oil for every steam turbine

the RIGHT base stock, Alchlor-processed

the RIGHT combination and concentration of additives

the RIGHT background of performance

Gulfcrest Oil has a background of successful performance in every type and make of steam turbo-generator.

In many of these installations the original charge of Gulfcrest has been in service more than 10 years with no significant change in its original characteristics, and with neutralization numbers always remarkably low and safe.

To get this kind of lubrication for your turbine, call in a Gulf Sales Engineer and ask him to recommend the proper grade of this superior oil. Write, wire, or phone your nearest Gulf office today.

Gulf Oil Corporation · Gulf Refining Company

Pittsburgh 30, Pennsylvania

GULF SERVES INDUSTRY

award $750 worth of school equipment to the winning town.

Second and third place winners will get $500 and $250 worth of equipment respectively. The two honorable mention winners will receive $50 in school gear.

Emphasis in the adult phase of the competition, to begin the first of the year, will be on obtaining results. Special adult committees will work on projects recommended by the youngsters. Adult committees may elect to work on separate projects, but, in any case, will be required to cooperate with a "Teen Council" of young leaders. Reports will have to be filed by Oct. 1, 1953.

Union Electric will again supply the prizes: $1,000 to finance improvements for the best accomplishment by a town; $750 for second; and $500 for third. Identical sets of prizes will be awarded to towns of under 1,000 population, and to those with from 1,000 to 7,500 population.

Controlling the House Heating Load

J. C. BECKETT, Chief Engineer, Wesix Electric Heater Co, San Francisco, Cal

Controlling electric space heating load by reducing the capacity of the heating system during milder stretches of winter weather has been studied by the Florida Power Corp.

An outdoor thermostat determines heating requirements and actuates a load regulator that changes the voltage on the heating units from 240 to 120 as the outdoor temperature rises above 60 deg F. When the mercury falls below 58 deg F. full voltage is restored.

Effect of the automatic control is shown in the accompanying table. Almost half the heating hours in the season are at reduced voltage. In Florida there are more heating hours at one-quarter capacity than at full capacity. This means lower kw demand for the utility and more uniform heating and comfort for the user.

Voltage Control Cuts Space Heater Demand

	Hours Heat Supplied				Times Heat Required at System Peak		
		Voltage to Heaters			Voltage to Heaters		
Season	Total hours	240	120	No heat	240	120	No heat
1950-51	4,344	1,138	1,813	1,393	44	68	75
1951-52	4,073	807	1,734	1,532	22	61	90

During the time of daily system peak, 60 to 75% of the coincident demands for heat were at reduced voltage. Resulting reduced kw demand for heating at the daily peak during these periods was accomplished without inconvenience to customers.

Utility Aids Dealers' Holiday Range Sales

A dealer cooperative program for range sales during the holiday season has been outlined by W. Grant Parry, general sales manager, New Jersey Power & Light Co, Dover, N. J. This season of the year, Parry believes, is an extra opportunity to secure many extra range sales.

The program includes special inducements for the electric range prospects and the dealers.

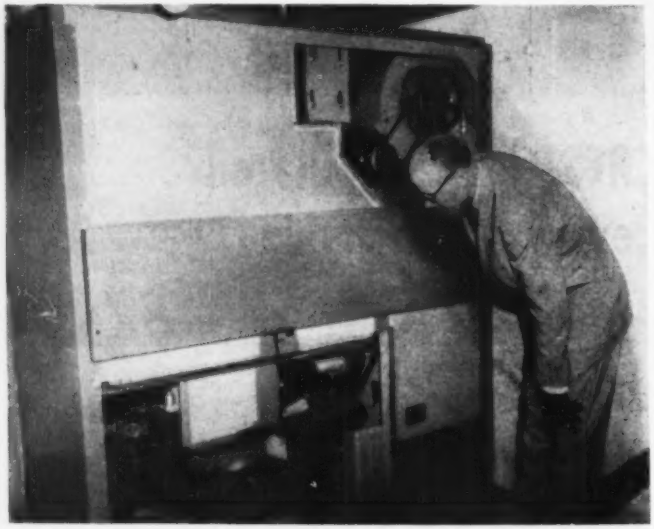
1. During the period November 1 through December 24 a wiring allowance is increased to $30.

2. The utility cooperates in an attractive trade-in offer—a deluxe set of 11 aluminum cooking utensils in exchange for the old range in the customer's kitchen at the time of purchasing the electric range. The utility shares the cost (conservative retail value $28.45) with the dealer paying only $7 for each set.

3. The utility prints and mails at its expense over 75,000 circulars illustrating and describing these offers. These circulars to be sent to all residential electric customers, urging them to see local dealers for details.

4. The utility follows up this offer with a series of newspaper advertisements in all of the papers published in the territory served.

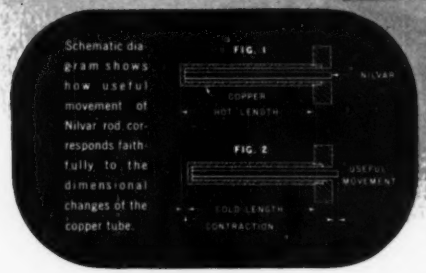
The dealers part—promote the program, see as many people as possible, advertise it in newspapers, and tie in with it by featuring ranges in the store windows and store displays.



Utility Gives Heat Pump Personal Test

Load characteristics of the residential air-to-air heat pump are being determined first hand by Utah Power & Light Co, at the home of W. A. Huckins, manager of the utility's business development department. Pump load consists of a 5-hp compressor motor and two smaller motors driving fans. At 230 volts, single phase, the unit draws a rated current of 30.5 amp. To determine demand and energy consumption, the heat pump is submetered through a 50-amp kilowatt-hour demand meter. During the first month, total demand, including other electrical load, was about 9 kw. Supplemental heating load is being registered on a separate demand meter and is being combined in heat pump meter to give total space heating load.

The Dimensional Stability of NILVAR* Spells Perfect Product Performance



Schematic diagram shows how useful movement of Nilvar rod corresponds faithfully to the dimensional changes of the copper tube.

Robertshaw-Grayson "Unitrol" fully automatic temperature control for gas water heaters

How Robertshaw-Fulton built a better Water Heater Control with Driver-Harris NILVAR

The new "Unitrol" Robertshaw-Grayson gas water heater control streamlines three essential controls into one valve body: a snap action thermostat, a snap action pilot, and a large-capacity gas cock. This reduces inventory for the water heater manufacturer and simplifies part stocking for the dealer.

The "Unitrol" provides a thermostat capable of delivering maximum amount of useful movement, by employing a copper tube enclosing a Nilvar alloy rod. The tube expands and contracts very appreciably in response to immersion temperatures. But the Nilvar rod, because it is dimensionally stable, does not vary in length. Since the free end of the Nilvar rod actuates the working gas valve, the slightest movement of the temperature-sensitive copper tube is fully utilized to control flow of gas to the burner.

Says Robertshaw-Fulton: "The outstanding dimensional stability of Nilvar actually permits minute changes in water temperature to regulate the heat supplied by the burner, thus assuring extremely accurate operation."

Nilvar has a temperature coefficient of expansion as low as .000001 per degree C., lowest of any alloy; comparable to that of quartz. Somewhere in your engineering operations such extraordinary dimensional stability may solve a problem—help to perfect product performance. We shall be glad to make recommendations based on your particular needs.

*T.M. Reg. U.S. Pat. Off.

Nilvar is produced only by

Driver-Harris Company

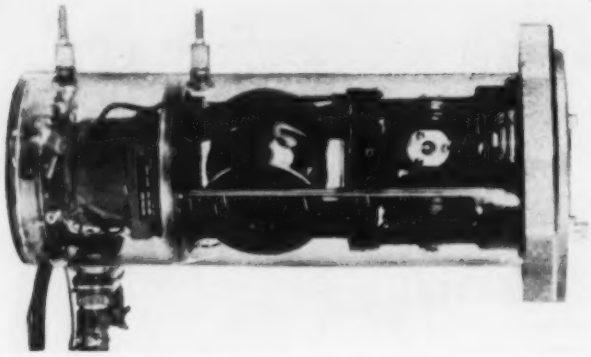
HARRISON, NEW JERSEY

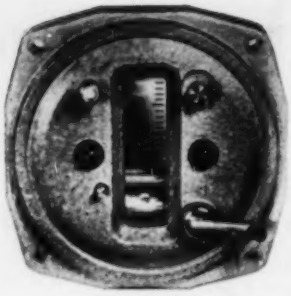
BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco

In Canada: The B. GREENING WIRE COMPANY, Ltd., Hamilton, Ontario.

MAKERS OF THE MOST COMPLETE LINE OF ELECTRIC HEATING, RESISTANCE, AND ELECTRONIC ALLOYS IN THE WORLD

NEW EQUIPMENT



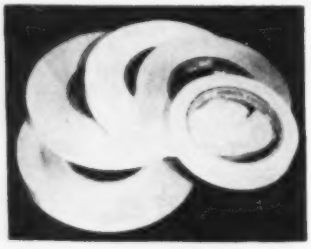


Pressure Measuring

To claimed accuracy of one part in 5,000, with sensitivity of one part in 15,000. Meter is 5-in. dia, 14-in. long, portable. It is claimed to be temperature stable, unaffected by mounting position or vibration.

600-in. scale shows ¼-in. intervals which are 1/10,000 of full pressure range. Scale is printed on 35-mm film strip. Meter responds to pressure drop when moved six in. above table. Meter is designed for laboratory standard, precision barometer or altimeter, level gage for large tanks, field precision testing. Available in manual-set or automatic servo-positioning models.

Fischer & Porter Co, Hatboro, Pa.



Electrical Tapes

That will not soften under temperatures 300-400 F, all with heat-curing masses. Five new tapes are:

P243 white acetate cloth—heat stable, non-corrosive backing, resistance to solvents.

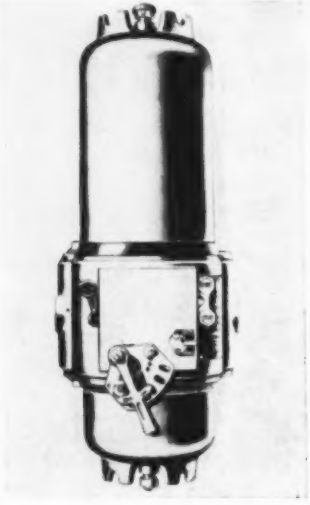
P242 acetate fiber—0.00088 in. cellulose acetate film laminated to 0.004 in. rope paper. For heavy duty coils, armatures. Claimed high mechanical and dielectric strength.

P252 orange-yellow polyester "Mylar" film—high insulation resistance and tear resistance.

P271 yellow flatback paper—heat curing adhesive, withstands heat, moisture, solvents.

P281 yellow crepe paper—heat-curing.

Industrial Tape Corp, New Brunswick, N. J.



Motor Controls

Explosion-proof line starters and circuit breaker condulets. Has built-in pushbutton stations and selector switches, reset mechanism, neoprene gasket between case joints. Aluminum alloy castings.

Available for line starters and combinations up to size 4.

Crouse-Hinds Co, Syracuse, N. Y.

Panel Instruments

Ruggedized to meet MIL-M-10304 spec, model 1521 class 52 is available 300 microamp to 8 ma dc. Tested for shock, vibration, bounce, thermal and humidity cycles, and immersion tests, simulating most severe service conditions.

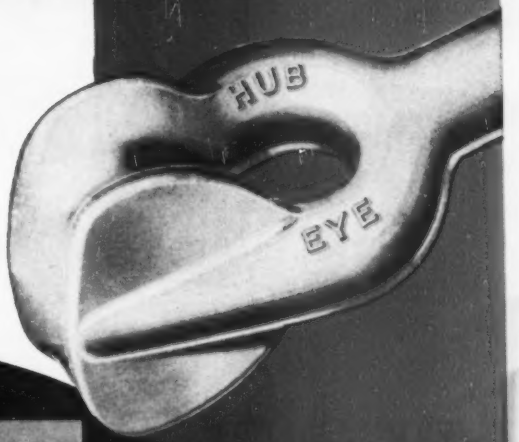
Weston Electrical Instrument Corp, Newark, N. J.

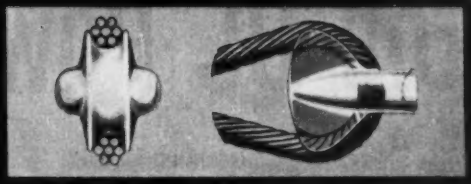
Multi-Range Meter

Portable volt- and millammeter for all necessary electrical measurement on radio communication systems in the field.

(*Continued on page 156*)

"For the Best GUYS in the World"





End view showing sidewall support of strand by Hubeye.

Side view showing lay of strand in Hubeye. Fully rounded bearing area is provided.

Typical Hubbard Guying Items

From arm to anchor, Hubbard has a complete line of guying accessories that are "good for the life of the pole." There's a variety of anchors to meet every soil condition, to carry any load . . . guy protectors that are designed for maximum strength and visibility . . . ServiSleevs for the best looking serve in five seconds flat . . . Hubeye anchor rods and bolts with strand protection . . . clamps that grip the strand and won't let go . . . strain plates . . . storm guy hooks . . . hundreds of items that make it easier for the lineman to service the "best guys in the world."

HUBBARD AND COMPANY

ESTABLISHED 1843

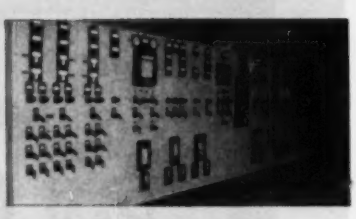
PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

ALLIS-CHALMERS

MERCURY ARC RECTIFIERS

1. Two of these Allis-Chalmers outdoor oil circuit breakers guard the power entrance to the plant and two more serve as tie breakers. Each breaker is rated 3 cycle, 1200 amps, 161 kv, 7,500,000-kva interrupting capacity.



2. Duplex, tunnel-type main control board is located in rectifier room. It meters and controls all equipment in plant — from the 161-kv oil circuit breakers down to the mercury arc rectifiers and plant power substations.

For Non-Stop DC Power

It's Allis-Chalmers from 154-Kv Lines to Rectifiers in New Defense Plant

UNINTERRUPTED POWER is indispensable in the production of high purity chlorine and caustic soda in two mercury-type cell lines at the new Government-owned, Monsanto-operated plant at Sheffield, Alabama. To help meet this requirement, Allis-Chalmers supplied all of the switching, transforming and rectifying equipment.

Here's How Power Reaches Rectifiers

Under the guardianship of Allis-Chalmers 7,500,000-kva breakers, the 154-kv transmission voltage is stepped down to 13.8 kv by two transformers — each equipped for forced cooling so that either can supply the plant in an emergency.

Backed up by 1,000,000-kva breakers, the main 13.8-kv switchgear splits the electrical system into two plant power and two rectifier power sections — with bus-tie and other special provisions for reliability.

Final distribution for each plant power section is made by unit substations. Each rectifier power section goes through regulating and phase-shifting transformers and six rectifier transformers. The power is then carried through high-speed anode breakers to the 12-tube rectifier assemblies.

Incorporating many exclusive Allis-Chalmers features, the rectifiers operate in two banks of six assemblies each, to supply the two 30,000-amp cell lines.

A-C Engineering Can Serve You

For a complete rectifier plant or a single factory-packaged rectifier unit, you gain by calling in your A-C representative or writing to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3875

WITH ALLIS-CHALMERS *EXCITRON* RECTIFIERS

You Get These 10 Mercury Arc Rectifier Advantages

- Compact and light weight — need no special foundation.
- Push-button starting with no synchronizing.
- High power factor (lagging).
- Low idling loss and high conversion efficiency.
- High momentary overload capacity.
- Immunity to frequent short circuits.
- No major moving parts—provides low maintenance and assures quiet operation.
- No attendance needed during operation.
- Resistant to dust, moisture, fumes.
- Simple construction for long life.

PLUS These 6 Exclusive Allis-Chalmers Features

Fixed excitation anode — doesn't contact mercury and is independent of level, turbulence or impurities . . . requires no adjustment, maintenance or replacement.

Continuous excitation — pilot arc always present. Eliminates need for continuous, synchronized re-ignition. Enables rectifier to ride through severe ac voltage disturbances.

Grid phase control — in cleaner region near anode, where ion density is lowest.

Internal cooling system — high heat transfer with seamless-tube cooling coil located within the rectifier.

Arc-over free tube — insulating entire arc path eliminates danger of arcing-over to tube.

Enamelled anode seals — multi-layer fused vitreous construction provides high-strength seal unaffected by thermal variation.

3. Regulated power for each six assembly rectifier bank is obtained from an auto-regulating transformer (left) supplemented by a 32-step regulator. Two phase shifters (right) are also used for each bank of rectifiers.

4. Rectifier transformers are alternately connected wye and delta. This arrangement plus phase shifters results in each six-transformer bank providing a 36-phase system that minimizes communication circuit interference.

5. Rectifier room, containing twelve 6000-amp, 600-volt, 12-tube, *Excitron*-type rectifiers. Each is a factory-assembled unit, complete with built-on evacuating apparatus, water-to-water heat exchanger, and water circulating, control and protective equipment. (See list at left for six **exclusive features** of Allis-Chalmers *Excitron* rectifiers.) In picture above at left are the anode breakers; at right, the cathode breakers with disconnect switches; and in the center, the excitation compartments containing excitation, phase control, vacuum measuring, and protective equipment.

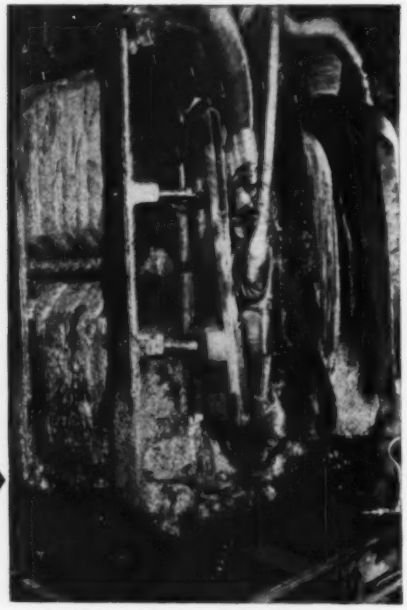
ALLIS-CHALMERS

Our Engineers Introduced Mercury Arc Rectifiers to U. S. Industry

Add DBPC

to your transformer oils . . .

to guard against sludge



• DBPC (Di-tert-butyl-para-cresol), added to transformer insulating oils, minimizes the development of sludge deposits, such as illustrated. DBPC slows down the rate of oxidation, retards sludge formation, adds extra life to the insulating oil, and promotes more efficient transformer operation.

Under accelerated oxidation tests, oil inhibited with only 0.3% DBPC has proved that it can outlast untreated oils by 14 times. The saving with DBPC is obvious.

In addition to its use as an oxidation inhibitor for transformers, DBPC can also be used in circuit breaker oils. Used here it does not affect arcing time, rate of gas generation, carbon formation or dielectric change.

DBPC is available in a white-to-yellow crystal that is readily soluble in oil and which can be added to either new or reclaimed oil. Or it can be purchased in a compounded oil solution under the Koppers trade name Impruvol 20. Specify DBPC inhibited oil to your transfomer manufacturer or your oil supplier. Or order DBPC directly from Koppers.

KOPPERS

KOPPERS COMPANY, INC.

Chemical Division, Dept. EW-122, Pittsburgh 19, Pa.

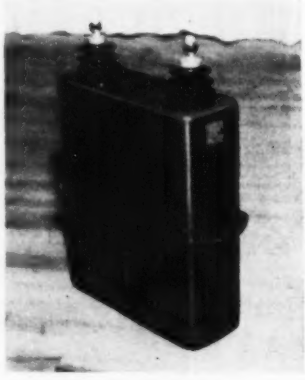
Type CX-7A, it measures current, voltage, and comparative radiated power. Receiver output can be adjusted for maximum quieting with meter's built-in speaker. Dimensions 8 x 5⅛ x 4½, weight four lbs.

Radio Corp of America, Camden, N. J.

Flame Detector

For safeguard against flame failure. Single element is a photoconductive cell responsive to infrared of any flame. Device operates through electronic controls.

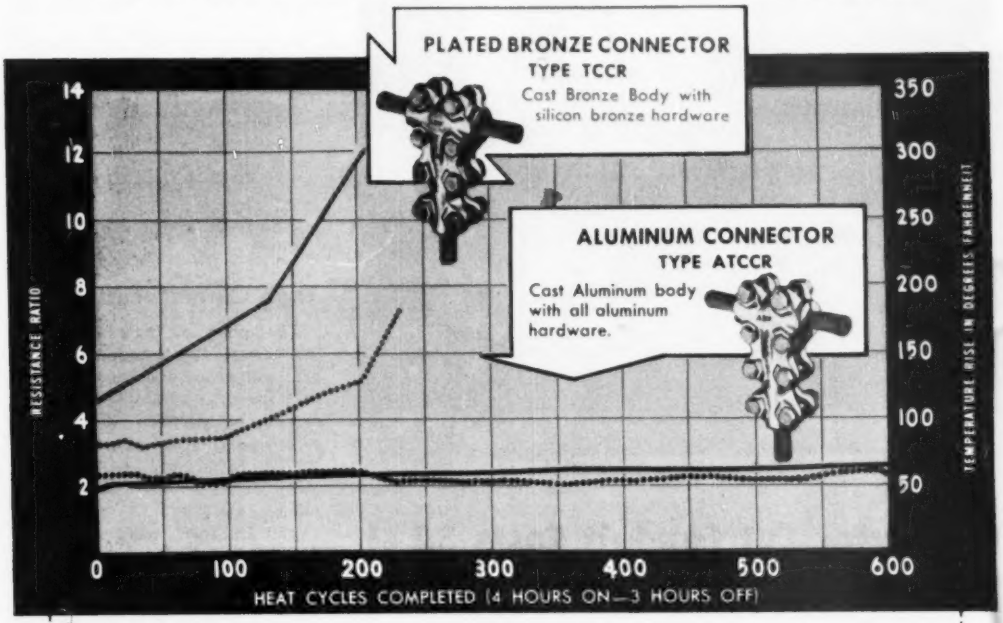
Combustion Control Corp, Boston 15, Mass.



7.5 Kvar Capacitor

For secondary network system voltages and high temperature and submersion conditions in vaults. Specifi-

CONNECTOR FAILURES Result from the Difference in Coefficient of Expansion of Dissimilar Metals



LEGEND
PLATED BRONZE CONNECTOR
———RESISTANCE RATIO
.....TEMPERATURE RISE

HEAT CYCLE TEST ON CONNECTORS FOR 1,000,000 cm ALUMINUM CABLE

LEGEND
ALL ALUMINUM CONNECTOR
———RESISTANCE RATIO
.....TEMPERATURE RISE

RESISTANCE RATIO:

This is the ratio of the apparent contact resistance of the fitting to the resistance of a piece of 1,000,000 cm aluminum cable of the same length as the length of contact.

- CABLE—1000 MCM Insulated all aluminum 61 x 0.1280 stranding
- HEAT CYCLE CURRENT—785 Amperes
- AVERAGE AMBIENT TEMPERATURE—70° to 80° F
- AVERAGE TEMPERATURE OF CABLE ABOVE AMBIENT—66° F

Be sure to specify Cast Aluminum Connectors with Aluminum Hardware when Connecting Aluminum Conductors

Consult one of our nearest 18 representatives or contact our main office

ANDERSON BRASS WORKS, Inc.
POST OFFICE DRAWER 2151
BIRMINGHAM, 1, ALABAMA

One man carries a two-man load! That's one of the advantages of aluminum conduit that helps . . .

Contractor Cut Conduit Costs 30%!

Cost records maintained by the contractor for the electrical construction of a large industrial plant indicate a saving of 30 per cent through the use of Alcoa Aluminum Electrical Conduit.

Approximately 560,000 feet of aluminum conduit were used on the job. Sizes ranged from ½" to 5" in diameter. The installation involved much material handling and fabricating, usually a significant part of final costs. Major savings were effected in these categories due to the light weight of aluminum conduit (about a third that of steel) and its ease of fabrication on the job site.

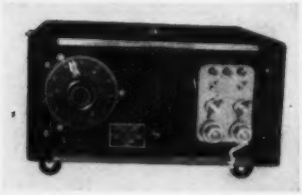
For additional information on Alcoa Aluminum Electrical Conduit call the Alcoa sales office listed in your classified directory under "Aluminum." Or write direct for Alcoa's new booklet.

ALUMINUM COMPANY OF AMERICA
1936-Z Gulf Building
Pittsburgh, Pennsylvania

ALCOA
ALUMINUM RIGID CONDUIT

cally designed for economical application to networks rated 208 and 216v, built for ambient to 131 F. Weight less than six lbs.

General Electric Co, Schenectady, N. Y.



High Current Test Unit

For testing and calibrating oil circuit reclosers, CSP transformer breakers, sectionalizers, overcurrent relays, etc. Output is adjustable in stepless increments from 0 to 1,000 amp in eight ranges. Each range is rated at 2.5 kva based on a four hour duty cycle. Terminal voltage are fully adjustable from 0 to 115% of 200, 100, 75, 50, 25, 10, 5, and 2.5v.

Multi-Amp Corp, Harrison, N. J.

Safety Switch

Front operated, fusible and no-fuse, 200 amp 600v HCI switch for industrial heavy duty safety switch needs. Felt gasket on this and smaller models blocks dust and dirt, so switches meet NEMA Type 1-A specs. Arc-quenching function similar to that of modern circuit breakers, giving switch high life expectancy.

Trumbull Elec Dept, Plainville, Conn.

Lightweight Pipe

Made of polyethylene, dia to 8 in., in lengths to 400 ft. For insulated raceways on pole-top crossarms. Di-

SABROOKE STATION, ROCKFORD, ILLINOIS . . .

The first unit of Central Illinois Electric and Gas Co.'s Sabrooke steam power plant provided 20,000 kilowatts of electricity for the fast-growing community of Rockford, Illinois. It was completed in 1949.

A unit of 30,000 kilowatts was added to the plant this year. Another installation of 30,000 kilowatts is scheduled to go "on the line" in 1954 and facilities are provided for the future installation of two additional generating units.

Stone & Webster Engineering Corporation was retained to design and construct the Sabrooke Station.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

Your Key to '53 . . .

YOU SHOULD BE HERE

. . . to see and learn about the latest developments in

HEATING VENTILATING AIR CONDITIONING

At Chicago's International Amphitheatre, from Jan. 26-30, you'll SEE *all* that's new, LEARN the latest trends and practices, GET a wealth of new ideas, and MAKE a host of valuable contacts during the 11th International Heating and Ventilating Exposition.

Over 300 technically-staffed exhibits will provide an exceptional opportunity for representatives of utility commercial departments and power sales engineers to get a first-hand look at the latest products for conditioning air in all types of buildings, plants, and homes . . . compare hundreds of new, improved items, large and small . . . find solutions to current and possible future problems by discussing them with engineering specialists . . . get MONTHS AHEAD in FIVE DAYS.

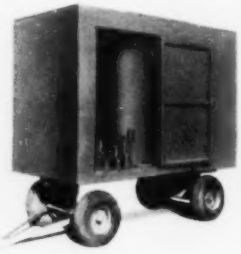
Arrange now to ATTEND and BENEFIT from this exposition of ideas and progress; the largest of its kind ever held.

INTERNATIONAL AMPHITHEATRE
CHICAGO
JAN. 26-30

11th Air Conditioning Exposition
INTERNATIONAL HEATING & VENTILATING EXPOSITION
Under Auspices of American Society of Heating & Ventilating Engineers
MANAGEMENT INTERNATIONAL EXPOSITION CO.

electric strength claimed 500 v/mil, breakdown voltage more than 20,000 v. Pipe is lighter than metal, flexible at low temperatures, corrosion resistant.

Carlon Products Corp, Cleveland, Ohio



Oil Purifier

Mobile, all-metal trailer for purifying oil quickly and easily in the field. Includes a portable insulating oil purifier, pump, motor, 7½-kva transformer, line strainer, wiring and controls. Unit measures 4x8x6 ft, will operate at capacities to 300 gph.

Honan-Crane Corp, Lebanon, Ind.

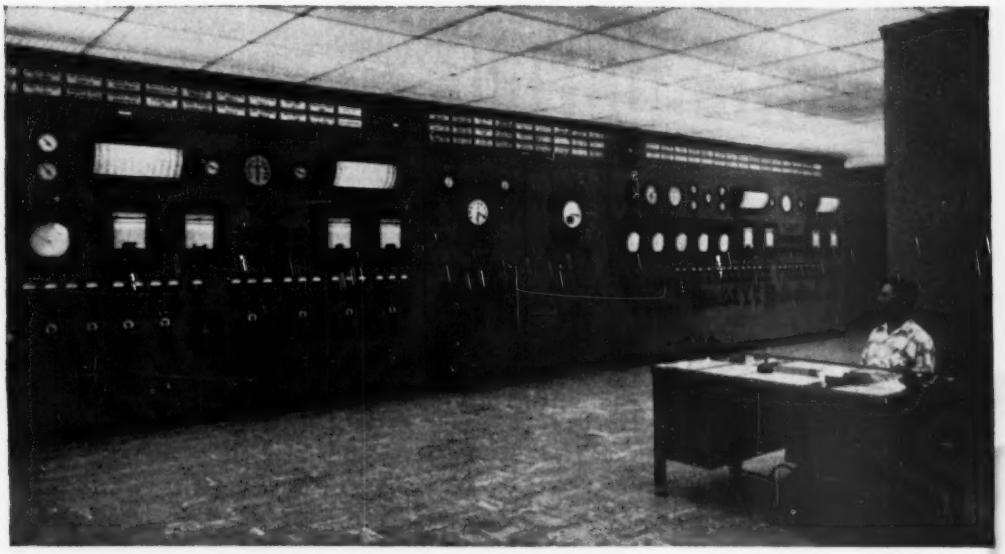
Insulating Compound

In roll form, applies like tape. ⅛-in. thick, designed to insulate and pad sharp edges, build up splices, etc, prior to taping. Dielectric strength 350v/mil, insulation resistance 100,000 megohms, in rolls 1½-in. wide, 5-ft long.

Minnesota Mining & Mfg Co, St Paul, Minn.

Capacitor Equipment

300-kvar, open-type, automatically switched, for 15-kv underground wye



Complete panels . . .

minimize engineering and installation time, reduce installed cost.

designed

Boiler, turbine and auxiliary control requirements are translated into a functional layout by our panel engineering staff. Upon your approval of the layout, we prepare final steelwork drawings, and electrical and piping diagrams. You thus receive drawings as a standard part of our panel engineering service.

assembled

Each panel is completely assembled in our plant. All instruments, switches and accessories are mounted, piped and completely wired. Easy access to wiring, piping and back-of-panel equipment is provided. Panels arrive ready to be connected to plant equipment.

tested

Every circuit, instrument and connection is double-checked . . . including hydraulic tests on pressure elements, electrical tests on wired components. You're assured of performance, not delay, at start-up time.

at L&N

Panels are custom-engineered by specialists who have built panels for many of the country's major utilities during the past fourteen years. L&N panel engineering is a *complete* service of the Leeds & Northrup Company, 4938 Stenton Ave., Philadelphia 44, Pa.

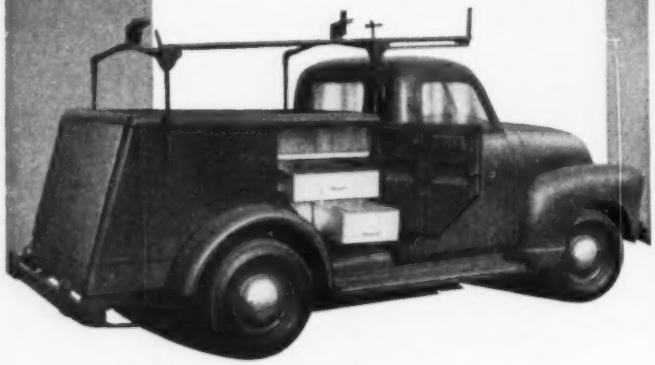
LEEDS LN NORTHRUP

INSTRUMENTS AUTOMATIC CONTROLS • FURNACES

Jrl. Ad N-460(9)

YORK-HOOVER
MODEL 201U76

new LIGHT DUTY SERVICE INSTALLATION BODY



WHAT THE MODEL 201U76 BODY WILL DO FOR YOU...

Light duty service work must be fast and efficient. Materials and tools must be readily accessible. That is why the new York-Hoover Model 201U76 Body was designed . . . especially for **your** light duty service work . . . for **your** convenience . . . for **quicker, better service.** Efficient design and sturdy construction, combine to provide this **faster, better service** for you . . . at **less** cost.

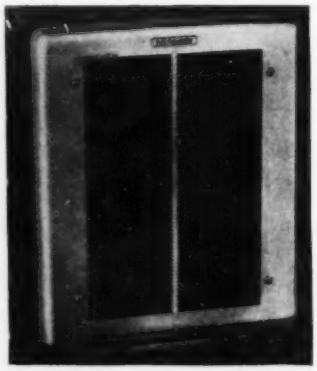
Write us today regarding your light duty service problems. We will be glad to provide you with all the details, including earliest possible delivery dates of the Model 201U76.

Bulletin No. 930 contains all the facts about our Model 201U76 Body. Write for your copy today!

1952...OUR 60TH ANNIVERSARY YEAR

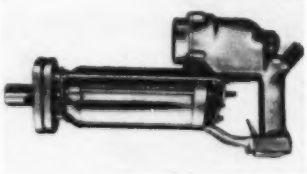
YORK-HOOVER CORPORATION
YORK, PENNSYLVANIA

or delta systems. Basic impulse level 95kv. The 25-kvar capacitors are mounted on pedestal insulators to increase insulation. Equipment is factory assembled and tested, is also available without switches for fixed capacitor equipment.
General Electric Co, Schenectady 5, N. Y.



Wall Heaters

With cast aluminum totally enclosed heating element, steel cabinet factory sealed motor and fan, built-in power cut-off safety switch. Built-in thermostat provides automatic room temperature control from 55 to 85 F.
Electrode Corporation, Rochester 3, N. Y.

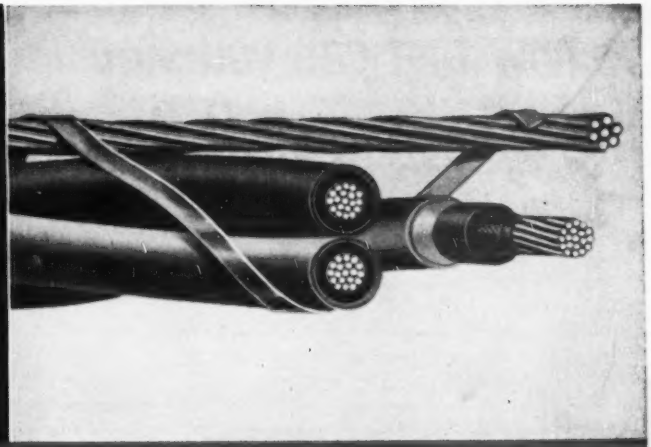


Hammer-Drill

Two in. capacity. 3,600 blows per minute of hammer piston rotate the bit, speed up drilling in concrete and masonsry. Available with spiralfluted carbide-tipped drill bit.
Syntron Co, Homer City, Pa.

Power Gas Burner

Designed to fit in vestibules of most gas and oil burning furnaces, inde-



Durable neoprene jacket protects aerial cable . . . assures long service

Today, neoprene-jacketed, self-supporting aerial cable is first choice for primary distribution lines. Neoprene's outstanding resistance to deterioration from sunlight, weathering, and abrasion means maximum protection to insulation . . . long service without failure.

In rural, residential, and industrial areas alike, neoprene-jacketed aerial cables have continued to operate despite long exposure to conditions which would normally cause "outages". . . such as the corrosive action of industrial smoke and fumes and abrasion by tree limbs. Ask your supplier about neoprene-jacketed aerial cable. It's available pre-assembled with built-in messenger or in individual cable lengths for "spinning" on the job.

Send for "The Neoprene Notebook." Each issue describes new, unusual applications of neoprene. Write today to: E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Div., Wilmington 98, Delaware.

NEOPRENE

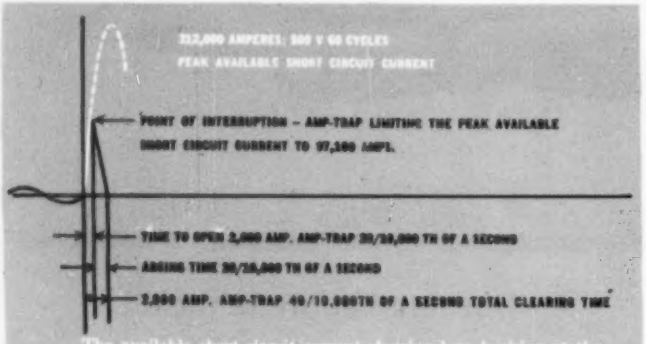
The rubber made by Du Pont since 1932

DU PONT

150th Anniversary

Tune in Du Pont "Cavalcade of America"—Tuesday evenings, NBC—coast to coast

how fast can you stop this dangerous short-circuit?


212,000 AMPERES: 500 V 60 CYCLES
PEAK AVAILABLE SHORT CIRCUIT CURRENT
POINT OF INTERRUPTION – AMP-TRAP LIMITING THE PEAK AVAILABLE SHORT CIRCUIT CURRENT TO 97,100 AMPS.
TIME TO OPEN 2,000 AMP. AMP-TRAP 29/10,000 TH OF A SECOND
ARCING TIME 20/10,000 TH OF A SECOND
2,000 AMP. AMP-TRAP 49/10,000TH OF A SECOND TOTAL CLEARING TIME

The available short-circuit current showing here is rising at the incredible rate of 35,000,000 Amperes per second. If unchecked, it can reach 212,000 Amperes at the peak of the first current loop. An explosive sledge-hammer blow of destruction can result.

A 2000 Ampere normal rating *Amp-trap* limited the peak available short-circuit current to 97,100 Amperes, or 46% of the 212,000 Amperes available. It did this in 29/10,000th of a second. The total fault clearing time was 49/10,000th of a second. Thus did Amp-trap stop this explosive short-circuit long before real destruction could occur.

SHAWMUT

Amp-trap

3000 AMP. 600 V Amp-Trap

Lightning fast *Amp-trap* not only prevents Supercurrents from building up to full magnetic or thermal destructive force — it actually destroys them.

Amp-trap gives Protection Engineers, Switchgear Designers, Contractors and Users new freedom and flexibility in laying out low voltage systems. *Amp-trap* solves the Supercurrent interrupting problem. Available in all standard sizes *Amp-traps* may be used with or without circuit breakers. Write for bulletins.

Est. 1893

AMP-TRAPS — Made At The Sealtest

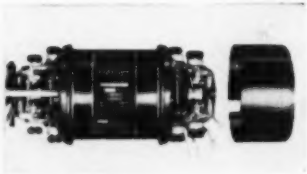
THE CHASE-SHAWMUT CO.

370 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS

Amp-trap Trion C-O-T C-O-T FUSE WIRE

pendent of chimney draft. Said to be high efficiency swirling flame gas burner. Pilot is electrically ignited; both pilot and main valves have automatic safety shut-off in case of flame failure. Available in three models, from 75,000 to 500,000 BTU.

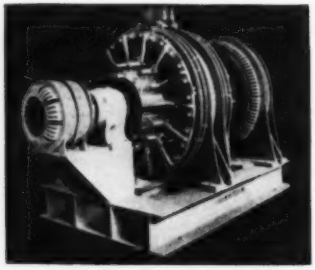
Synchronous Flame Inc, Chicago 4



Dynamotor

Operates from 6, 12, or 24 v, output 500 v at 0.100 amp. 10¼-in. long x 4½ in. dia, weight 11½ lbs. Rated temperature rise 50C. Four winding, four commutator armature. For communications or laboratory power.

Electro Engineering Products Co, Chicago, Ill.



Motor-Generators

All-welded steel construction. Brushes, coils and commutator accessible for inspection, cleaning, or removal individually. Field poles and windings easily removed.

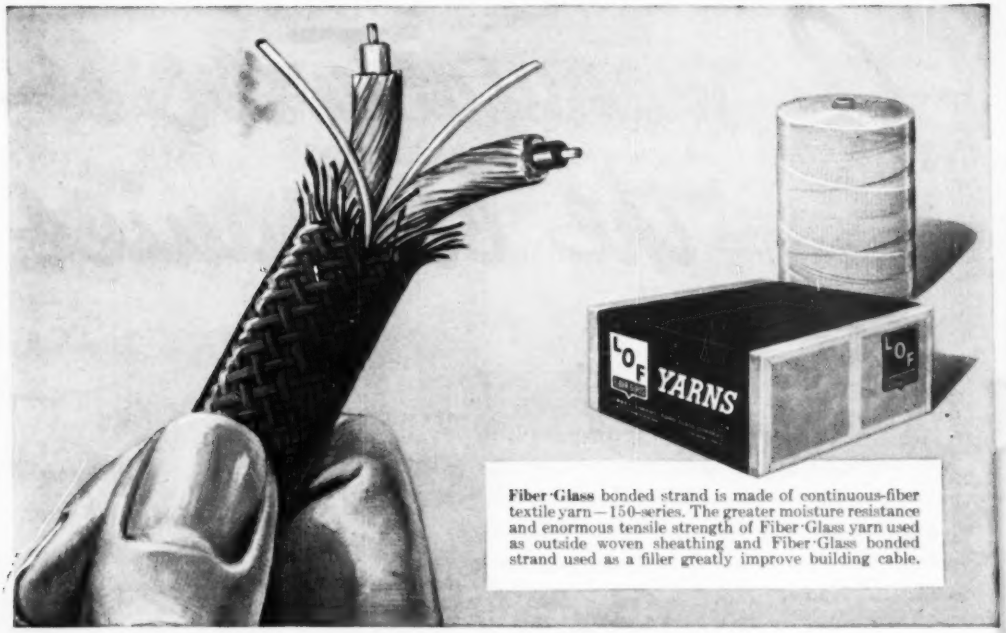
Prime mover is direct-connected, low speed, heavy duty synchronous motor with 80% leading or unity power factor. Generators available 300 to 20,000 amp at specified voltages.

Chandeysson Electric Co, St Louis, Mo.

Miniature Resistors

10-w size ⅜x¾-in., 15-w size ⅜x1 in. Wound on oval steatite cores with

(*Continued on page* 169)



Fiber·Glass bonded strand is made of continuous-fiber textile yarn—150-series. The greater moisture resistance and enormous tensile strength of Fiber·Glass yarn used as outside woven sheathing and Fiber·Glass bonded strand used as a filler greatly improve building cable.

It's surprising what two little strands can do in a cable

Libbey·Owens·Ford's 50 years' experience in glass making helps make better electrical material

DID YOU ever notice how a cable suspension bridge is built? Huge anchored cables stretching over high towers carry the load because of the enormous tensile strength of the cables.

The electrical industry today has nonmetallic, sheathed cable that is lighter and stronger because of two little strands of fiber glass which act as filler strips. Bonded strands, made of L·O·F Fiber·Glass, make it possible for cables to better support their own weight.

L·O·F Fiber·Glass has gained wide acceptance as superior electrical insulation on motors and generators where space and overloads are factors. Fiber·Glass resists temperatures up to 800 degrees F. It has low moisture pickup, is rotproof and resists the effects of corrosive liquids and gases.

Investigate the ways you can use L·O·F Fiber·Glass as insulation for your electrical products. Contact the nearest L·O·F office (district offices in 26 major cities). Or write, wire or phone Libbey·Owens·Ford, Dept. F·G 10122, Nicholas Building, Toledo 3, Ohio.

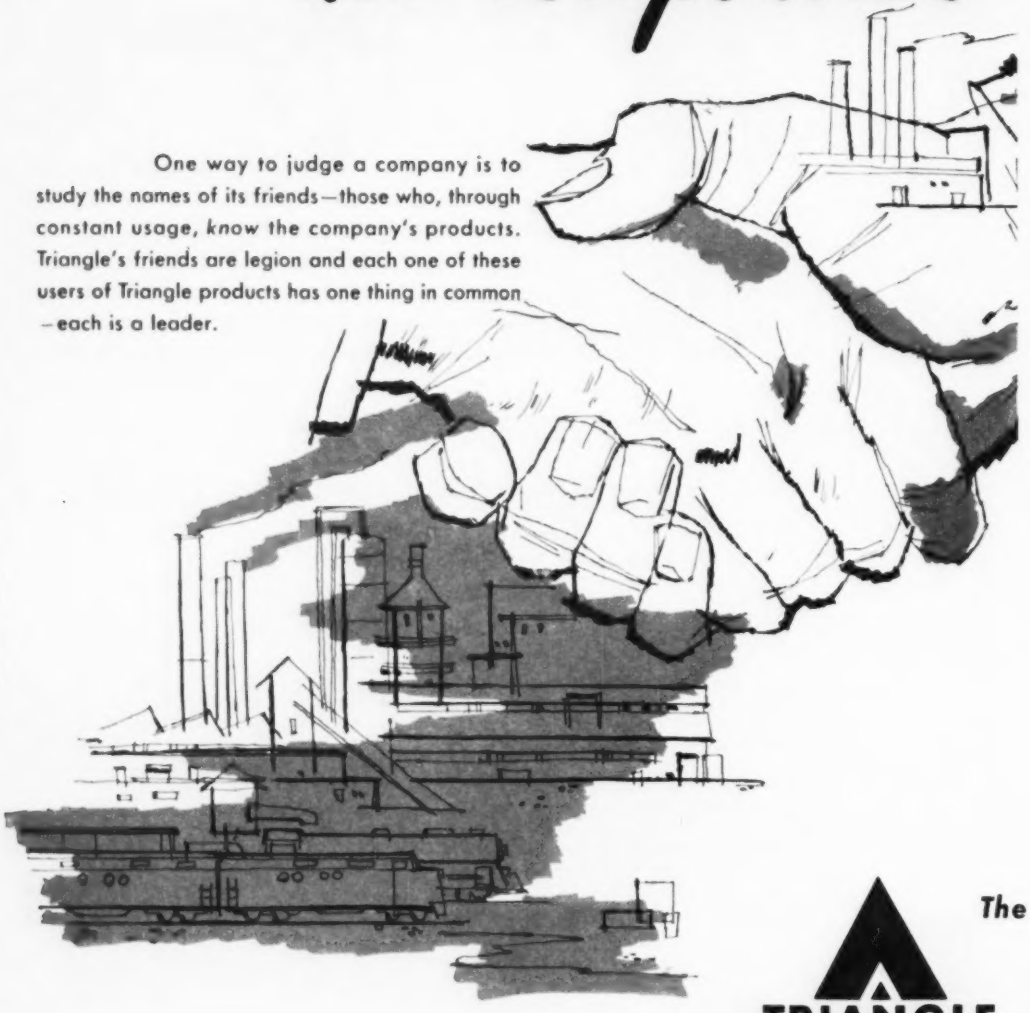
L·O·F GLASS PLASKON L·O·F FIBER·GLASS

LIBBEY·OWENS·FORD GLASS COMPANY
FIBER·GLASS DIVISION

FIBER·GLASS

A manufacturer is the companies

One way to judge a company is to study the names of its friends—those who, through constant usage, *know* the company's products. Triangle's friends are legion and each one of these users of Triangle products has one thing in common—each is a leader.

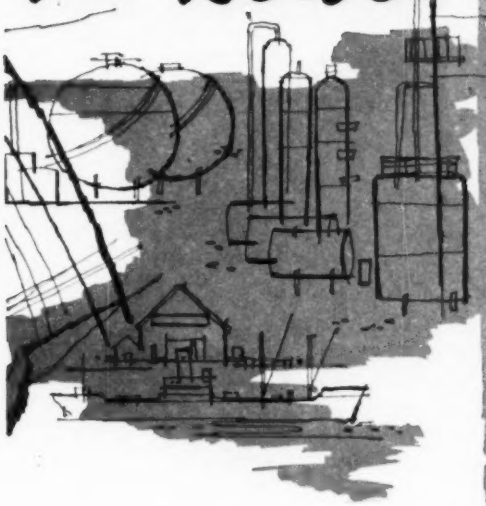


The

TRIANGLE

IT MUST BE RIGHT

known by it serves

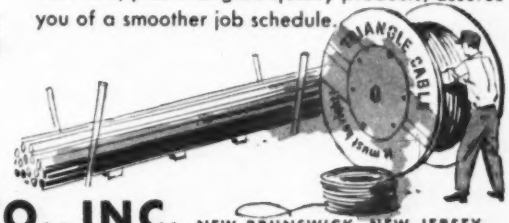


A partial list of projects on which Triangle Wire, Cable or Conduit have recently been used.

General Motors Corp.
(Argonaut Realty Division)
Ford Motor Company
Chrysler Corporation
Owens-Corning Fiberglas Corp.
The Glenn L. Martin Co.
Bendix Aviation Corp.
Douglas Aircraft Co., Inc.
The Dow Chemical Company
Heyden Chemical Corp.
Hercules Powder Co., Inc.
Monsanto Chemical Co.
Wheeling Steel Corp.
Lockheed Aircraft Corp.
Fluor Corp., Ltd.
E. I. DuPont de Nemours & Co., Inc.
Radio Corporation of America
Joseph Schlitz Brewing Co.
Anheuser-Busch, Inc.
Pabst Sales Co. · The Budd Company
Sun Oil Company · The Texas Company
Phillips Petroleum Co.
Esso Standard Oil Company
The Worthington Corp.
Ingersoll Rand Company
Reynolds Metals Co.
Atomic Energy Commission
Weirton Steel Co. · Kaiser Steel Co.
Packard Motor Car Co. (Tanks)
New York Shipbuilding Corp.
New Jersey Turnpike Authority

Why is it that month after month, year after year, Triangle is specified on projects for America's leading industrial firms? Industry takes to Triangle products because Triangle gives industry what it wants. Triangle's highly engineered wire, cable and conduit is top quality. The Company's service—through an efficient nation-wide network of recognized electrical distributors, district offices and warehouses, is fast, reliable and helpful. No matter who you are—contractor, maintenance man, superintendent, vice-president, electrician, electrical engineer, contact the nearest Triangle Distributor. Your requirements will be given meticulous attention. This, plus Triangle's quality products, assures you of a smoother job schedule.

Trade Mark of TOP Quality



CONDUIT & CABLE CO., INC. NEW BRUNSWICK, NEW JERSEY

"Glazon" Building Wire • "Glazon" Non-Metallic Sheathed Cable • Control Wire • Armored Cable • Service Entrance, Service Drop Cables • Varnished Cambric, Braided or Leaded • Trioprene Trench, Power & Parkway Cables • Bare Wire • Rigid Conduit, Hot-Dipped Galvanized & Black Enameled • Electric Metallic Thin Wall Conduit • Flexible Steel Conduit.

Free Booklets

tell all about aluminum wire

Get the full facts about United States Rubber Company's Aluminum Wires and Cables. These two clearly written, informative booklets are packed with data on specifications, standards, photographs showing stripping, joining, soldering—installation facts of all kinds, plus property tables. In addition, there is a table showing how "U. S." Aluminum wire's insulation properties compare with Underwriters' Laboratory Standards.

These booklets are FREE. Send for your copies today!

United States Rubber Company

Electrical Wire and Cable Department
1230 Avenue of the Americas
ROCKEFELLER CENTER • NEW YORK 20, N. Y.

silver-soldered connections, coated with brown vitreous enamel. Samples on request.

Milwaukee Resistor Co, Milwaukee, Wis.

MORE NEW PRODUCTS
about which you should know

Emerson Radio Corp, New York 11, N. Y., has a **communications receiver,** AN/GRR-5, operating from dry battery, storage cell, or ac line. Preset channel operation, built-in crystal calibrator. Set is fully tropicalized . . . Mitchell Mfg Co, Chicago, Ill, has four-ft or eight-ft 38-w model flourescent **trouffers,** employing one to three lamps. Single pin lamps, instant start, slimline type.

Westinghouse Electric Corp, Pittsburgh, Pa, has a shallow surface **luminaire** 3 5/16-in. deep, in 4, 6, 8-ft lengths, two or four lamp widths wide, for a variety of slimline and standard fluorescent lamps. Hinged down louvers provide 35 deg shielding crosswise and endwise, some light is emitted to ceiling . . . Edwin L Wiegand Co, Pittsburgh, Pa, has a heavy duty electric **heater** to preheat studs to clamp large castings. Stud heater lengths 10-70 in., capacities 2-12 kw, diameters ½-1 in.

Ideal Industries, Inc, Sycamore, Ill, announces an industrial **Test-Glo** for testing motors, fuses, circuits to 600v, ac or dc. Device has 24-in. lead wire between probes, five in. handles, 10,000-v lead wire . . . Syntron Co, Homer City, Pa, has added model EB-00 **parts feeder** to its line. Device aligns and positions parts for machining, packaging. Handles parts from 1¼ x ¼-in dia to ½ x 1/16-in dia.

Abbeon Supply Co, Jamaica, N. Y., has an electronic **deodorizer** using Westinghouse Odorout bulb which emits light rays that change oxygen to ozone. Ozonated air oxidizes and destroys odors present. Unit weighs 3 lb, measures 4⅝ x 2¼ x 6⅞ . . . Martindale Electric Co, Cleveland, Ohio, has Type C **commstone holder** for concentric resurfacing of commutators and slip rings while running at normal speeds in their own bearings. Holder is 3¼-in. wide, fits close quarters.

THE DIAMOND "UTILISCOPE"
(WIRED TELEVISION)

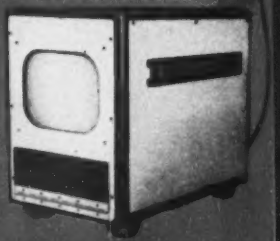
An employee who...

Requires no pay check
Never makes a mistake
Works 24 hours a day
Never takes a vacation

Many industrial operations that must be watched continuously and formerly required the individual attention of a man, are now being done without the man . . . by using a Diamond "Utiliscope" (Wired Television). The camera takes the place of the man . . . the monitor or receiver brings an exact picture of what is happening (as it happens) to a remote central control point or wherever else desired.

The "Utiliscope" is surprisingly low in cost. Its image is always clear and stable—it cannot transmit an incorrect image. It is on the job 24 hours a day, day in and day out, with practically no attention. The "Utiliscope" has no human limitations.

Let us tell you how the "Utiliscope" is now saving manpower, improving product quality, increasing production or preventing accidents. There probably is an application you can use to advantage. Write for Bulletin.

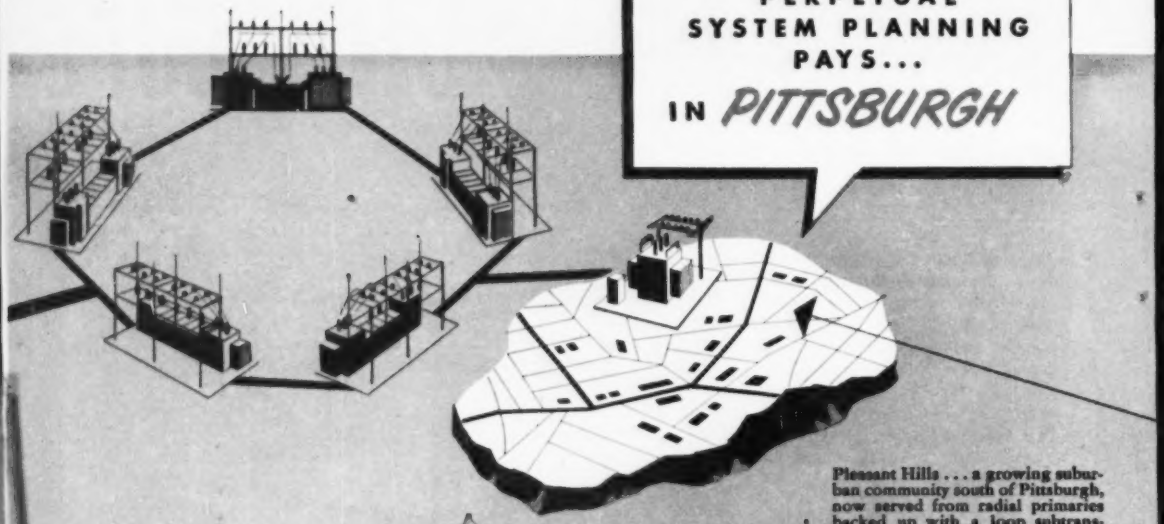


WRITE FOR BULLETIN 1025W

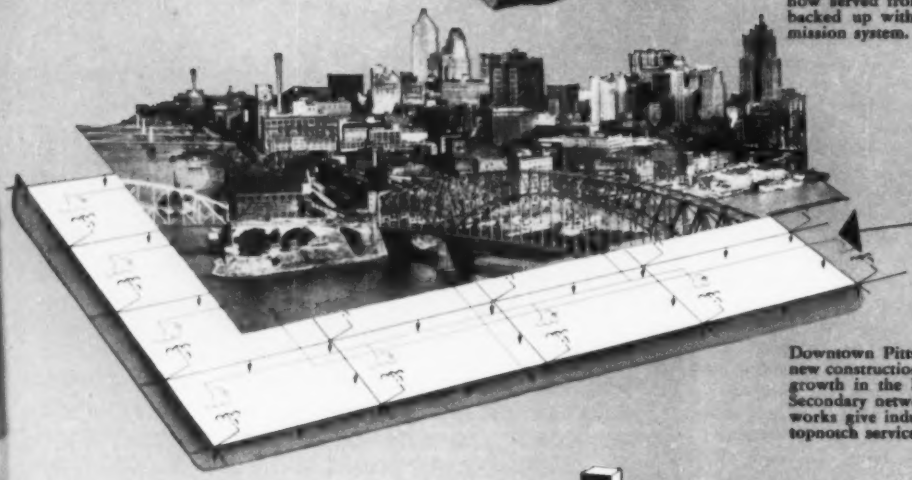
TYPICAL USES—Checking remote gauge readings • Watching flow of molten steel • Viewing nuclear research • Observing conditions inside furnaces • Coordinating materials flow on conveyors. • "Utiliscope" (Reg. U.S. Pat. Office)

DIAMOND POWER SPECIALTY CORP.
FIRST IN INDUSTRIAL TELEVISION
LANCASTER, OHIO • OFFICES IN 39 PRINCIPAL CITIES
Diamond Specialty Limited—Windsor, Ontario
Since 1903, Diamond has Manufactured Quality Equipment For Industry

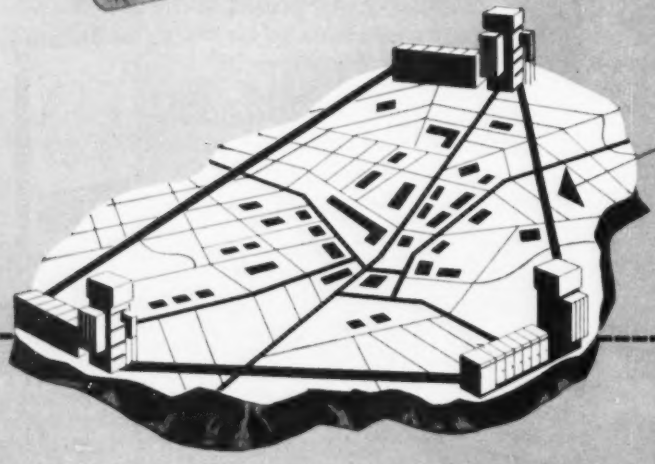
PERPETUAL SYSTEM PLANNING PAYS... IN *PITTSBURGH*



Pleasant Hills . . . a growing suburban community south of Pittsburgh, now served from radial primaries backed up with a loop subtransmission system.



Downtown Pittsburgh . . . there's new construction and constant load growth in the booming Triangle. Secondary networks and spot networks give industry's nerve center topnotch service.



Squirrel Hill . . . a concentrated residential community including a large shopping center. Primary networks backed up with a loop subtransmission system, meet the problems of this medium load-density area.

"Simplified Systems

meet our load growth . . . reduce distribution costs"

In Pittsburgh you'll find all the benefits from almost 30 years of sound system planning. Main benefit—complete flexibility to meet all load growth economically.

Duquesne Light Company take full advantage of the latest advances in the design and reliability of modern unitized electrical apparatus. Small blocks of power are integrated to improve their own unique Service Continuity Standards without uprooting the entire system.

CASE I Greatly increased load with subsequent voltage problems necessitated improved service continuity and the elimination of line losses for this suburban area. Proper system planning utilized a nearby subtransmission loop by installing a unit-type single-feeder substation. Pleasant Hills gets adequate service and costly field-erected substations are eliminated.

CASE II Secondary networks have provided Pittsburgh's Triangle with the highest quality of service since 1926. Badly congested primary feeders and small transformer installations were eliminated. Duquesne Light Company also offers the spot network form of the system for large commercial buildings. Sound planning enabled Pittsburgh to grow without any basic changes in the system.

CASE III 4 kv primary networks were installed in 1949 to economically meet the Service Continuity Standards for this medium load-density area. Careful planning based on load growth, income potential and geographic conditions dictated the necessity for a primary network system. Now, service continuity is high and there's complete flexibility to meet any increase or change in load density.

BECAUSE OF SOUND PLANNING, systems have been simplified, small blocks of power integrated, high service standards maintained, power distribution costs reduced. Westinghouse equipment and co-ordinated distribution apparatus have contributed to the ease and speed of changeover, dependability, and economy of this model operation. Use Westinghouse as your planning partner. Call us when you're ready to modernize. Start modern planning now!

J-97154

YOU CAN BE SURE.. IF IT'S
Westinghouse
SYSTEM PLANNING SERVICE

LETTERS TO THE EDITOR

Burden Not Overhead

To the Editor:

Among the Letters to the Editor contained in the Aug. 25 issue, there was one from Mr William H. Hamilton asking "What Word Do You Use" when speaking of general expenditures ordinarily thought of as "Overhead."

Even when considering operations of similar character, intelligent comparison of overhead expense is hardly possible unless the various items included therein are known. The task becomes difficult and perhaps futile if an attempt, for example, is made to compare the "overhead" of an industrial enterprise with that of an agency of the Federal Government such as the Bureau of Reclamation in the construction of an irrigation project. In either case there, no doubt, would be items of expense that normally would be necessary but not properly considered as "Overhead."

Mr Hamilton's suggested use of "burden," or some other word, in the designation of such items appears to have merit. Most certainly, more careful use of the term "Overhead" is to be desired, particularly when comparisons of "Overhead" are made. Confusion is apt to result unless there is an accompanying statement of items included.

Walker R. Young
President
Thompson Pipe & Steel Co
Denver, Colo.

BPA Field Tests

To the Editor:

I saw your statement under "Electrical Week" in the Nov. 10 issue that there will be no more field tests of big breakers on the BPA system for some time, perhaps indefinitely, because of a failure of a large power transformer arising from stresses growing out of tests. This statement is not quite correct and could be misleading. The facts are these:

1. BPA, long before the transformer failure, decided against major circuit breaker tests on the system until our system facilities are less critically loaded.

2. The failure occurred at our Spokane Substation where a section of high voltage submarine cable was being tested in connection with the design of a cable for the Puget Sound crossing.

3. During the course of the tests the transformer was subjected to less than five times normal load current for periods on the order of six cycles. The transformer was designed to withstand 16 times its rated full load current.

4. The cable tests were resumed and carried to completion shortly after suitable adjustments were made at the Spokane Substation.

5. Our decision to postpone temporarily minor testing of field equipment pending investigation of the transformer failure has now been withdrawn, and we are planning to proceed with such tests.

6. It is our plan after system conditions show sufficient improvement, to resume major field testing of circuit breakers whenever it is to our interests to do so.

S. E. Schultz
Chief Engineer
Department of the Interior
Bonneville Power Administration
Portland 8, Ore.

• We're glad.

More Orange Juice!

To the Editor:

Regarding O.K. LeBlanc's letter entitled "A Lot of Orange Juice," in the November 3, 1952 issue of your magazine—

How wide is an acre?

Walter Castle
Castle Engineering Co
Dayton, Ohio

• As broad as wit and as narrow as a viewpoint! Editor.

A Bit about Sheathing

To the Editor:

This Technical Note appeared in the Sept. 8 issue: "Lead (99%) alloyed with antimony (1%) according to telephone experts is the best sheath material for all around service in cable sheaths."

Knowing the original source of this information, I must challenge the accuracy of your note. The original source said, "Small or fractional percentages of tin, calcium, silver, and zinc have been alloyed with lead with reasonable success, but for all around service 1% antimony with 99% lead is now most generally used."

As I interpret this statement, it merely states that antimony is the best metal to alloy with lead. It says nothing about this alloy being the best sheath material.

Now there is little doubt that Bell Laboratory men are experts. But I would limit their expertness to telephone cable and partially limit it to paper-lead telephone cable. For example, lead-alloy sheaths are rarely used in power cable. And when they are, it is usually to withstand power load cycle, bending fatigue, an entirely different problem from telephone cable sheath which is usually vibration fatigue. For cyclic load bending people like Anaconda or Okonite use an arsenical lead or something like that—not antimony. The point is that the problems need different treatments.

If my longtime information is correct, tin of 2-3% can be mixed quite easily and uniformly with most any lead and gives a uniform dispersion for easy bending and flowing bond with the lead particles. Antimony, on the other hand, preferably needs something like St. Joe lead to work best in getting an initial and permanently uniform mixture.

Western Electric Co nicely takes care of this in their lead purchases and in a precise mixing and blending technique in their plants. This is quite expensive unless you are handling large tonnages of lead; so the smaller lead cable maker may not always find it a welcome procedure.

And I insist that the economic angle played a large part in the change from tin to antimony. With 2½% tin at 80¢ per lb and 1% antimony at 15¢, 1% antimony is a powerful argument against 2% tin. And the economic argument is playing a strong part in the general changeover from lead to non-lead sheaths. On the AIEE inspection trip to Bell Labs in February, their guides stressed the vast savings in the use of Alpeth and Stalpeth cables. So there is considerable doubt as to whether antimony lead makes the best sheath material.

H. G. Burd
1339 Clairmont Circle
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In an industry where so much depends on service, Amcreco offers facilities second to none. But even more important, these facilities are backed by wood preserving experience and know-how that results from nearly half-a-century's intensive study and research into wood preserving methods and problems.

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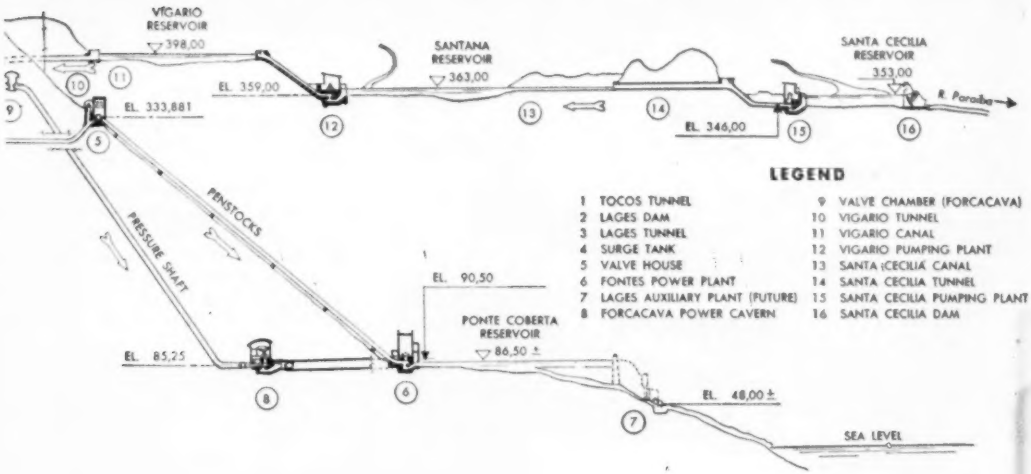
THEY'LL CONTROL PARAIBA AND PIRAI WATERS FOR ONE OF THE WORLD'S LARGEST UNDERGROUND POWER STATIONS

BALDWIN

Schematic profile of the hydro-electric developments on the Paraiba, Pirai and Lages Rivers showing Forcacava Valve Chamber and Fontes and Forcacava Power Stations.



FIVE 17-FOOT BALDWIN VALVES

to control river diversions for Rio

Soon a big, new project on the Serra do Mar plateau behind Rio will make the waters of both the Paraiba and Pirai rivers available to that power-hungry city. Once completed, it will raise the production of Rio de Janeiro Tramway Power and Light to over 4-billion kwhr a year.

Key control point will be the Forcacava Valve Chamber. From here the waters will be directed to Fontes or Forcacava No. 1 or No. 2 power stations.

Five 17-foot butterfly valves designed and manufactured by Baldwin-Lima-Hamilton Corporation are now being installed at the Forcacava Valve Chamber. Each is designed for a normal operating head of 212-feet—a maximum surge head of 280-feet. To provide the 1,700,000-ft. lbs. of torque for opening and closing these valves, operating pressures of 1500 to 2500 psi will actuate two servo-motor cylinders on each valve.

Whenever you are in the market for hydro-electric valves or turbines, our engineers will be glad to put their experience at your service. Because they can offer all basic types of turbines, they will give you unbiased opinions on the designs best suited to your flow or head conditions.

This type of equipment is also manufactured by our subsidiary the Pelton Water Wheel Company, 2929 Nineteenth Street, San Francisco 10, California.

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WHAT THEY'RE SAYING

At Industry's Meetings

Do More, Earn More

B. L. ENGLAND, president, Edison Electric Institute, before the Indiana Electric Association, French Lick, Ind.

Electric Power is synonomous with progress and modernity in industry, home and farm. Farm electrification, bringing power to the farmer is about completed. Now the task is to make electricity do more and earn more for the farmer. Electricity is the basic answer to "how you're gonna keep 'em down on the farm." Youngsters with vision and intelligence will see how tremendous are their farm opportunities.

Usage Will About Double by 1962

TOMLINSON FORT, vice president in charge of apparatus, Westinghouse Electrical Corp, speaking before the company's Pacific Coast District staff, San Francisco, Calif.

We expect, conservatively, that total use of electric power will increase by more than 90% in the next decade. This optimism is based upon a projected population increase, a demand for a still higher standard of living, the need for increased productivity per worker, and continued plant expansion and modernization to keep up with technological developments.

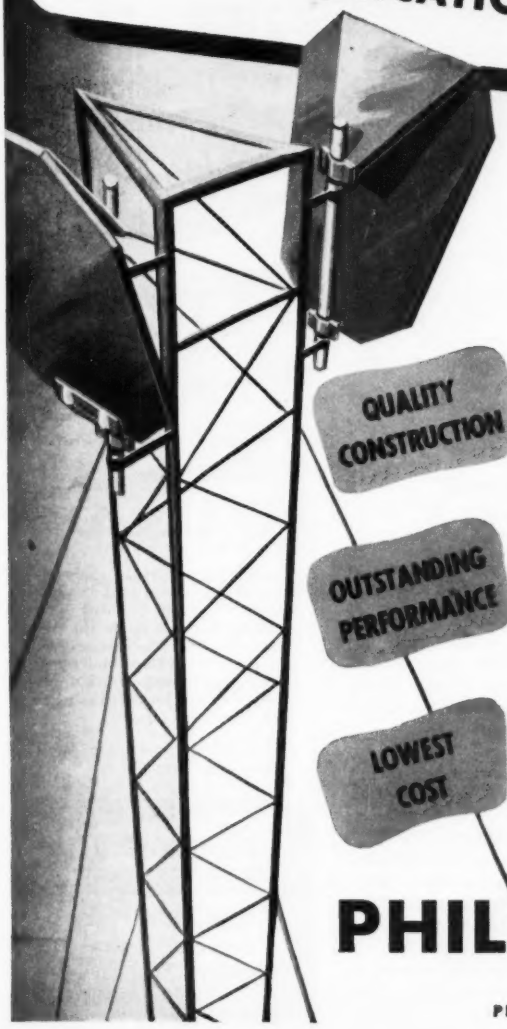
Westinghouse is building engineering "know-how" and plant capacity to meet a doubled demand for electricity by 1962. We have broken ground near Raleigh, N. C., for a new $10 million plant to make watthour meters. Two new plants have recently started turning out electronic tubes. These are part of a 300 million dollar expansion of facilities which will increase our capacity 50% by 1955. Previous expansion up to 1948 also increased our facilities by 50%.

Because research and engineering developments are important phases in the long range program, a new $5.5 million research center is being built at East Pittsburgh, Pa., for fundamental research and a $6 million steam and gas turbine laboratory is under construction in South Philadelphia, Pa.

DON'T SETTLE FOR LESS!

PHILCO

Advanced Design MICROWAVE COMMUNICATIONS SYSTEMS



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OUTSTANDING PERFORMANCE

LOWEST COST

Again Philco leads the way . . . with Philco *Advanced Design* Microwave Communications Systems. Philco's years of experience in microwave development has produced a system unsurpassed in reliability, performance and economy.

All components are of the finest quality, conservatively rated, insuring long life and economical operation and maintenance.

A signal level 1000 times greater than normally required insures dependable service even under the most adverse conditions. Philco *Advanced Design* Microwave is flexible. The broadband microwave channel may be divided to carry up to 24 simultaneous 2-way telephone conversations . . . or be further divided for telegraph, teletype, telemetering, signaling or supervisory circuits.

Years of production experience enable Philco to produce microwave systems for the lowest possible cost consistent with highest quality. Future expansion can be easily accomplished with no loss of original investment.

For dependable communications service 24 hours a day, every day of the year . . . *don't settle for less* than Philco *Advanced Design* Microwave Communications Systems!

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INDUSTRIAL DIVISION

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Only
PLUGMOLD 2000
gives you SWITCHED
and HOT OUTLETS
in the
SAME Receptacle!

WIREMOLD's exclusive SNAPICOIL eliminates multiple connections between short lengths – receptacles are pre-wired in 50 foot coils.

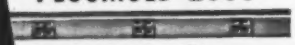
The Snapicoil 3-wire duplex receptacles of the new Plugmold 2000 multi-outlet system have one side *switched* and one side "*hot*"—this exclusive Plugmold feature means *extra* convenience in homes, stores, offices . . . everywhere.

The same size Plugmold 2000 raceway also accepts Snapicoil 2-wire duplex all "hot" or NEMA 2-wire grounded receptacles. Only *one size raceway* is needed on the job!

Plugmold 2000 is easier, faster and cheaper to install!

Write today for the new, free Plugmold 2000 book!

PLUGMOLD 2000



WIREMOLD'S *New* multi-outlet system

THE WIREMOLD COMPANY
Hartford 10, Connecticut

Seven Leadership Qualities

T. O. ARMSTRONG, director, Westinghouse Electric Corporation before the Industrial Management Club at Wheeling, West Va.

Seven qualities for leadership are one, the desire to be a leader, two, a willingness to acquire and to pass on to others knowledge beyond the job requirements, three, humility four, realize that everybody wants to be somebody. Five, recognize each person is different, six, realize all persons want to be recognized, and seven and last of all enthusiasm and pride for the company.

Troubles No Secret

JOHN REYNOLDS, Sunday Editor, Cedar Rapids Gazette before a group of Utility executives at Cedar Rapids, Mich.

A utility company's troubles are for the most part no secret to the public and it is the responsibility of the company to report them accurately and promptly to the public in its service area.

Even in so simple a case of trouble as gas or electric service interruption, the utility company is immediately involved in two principal obligations. The obvious one is to get the service back on, and the second and equally important one is to inform the public by press and radio as to what has happened and why, and what the result will probably be. The report must be honest.

Automatic Production

HARRY LEE WADDELL, editor, Factory Management & Maintenance, before the Annual Meeting of the American Society of Mechanical Engineers at New York City, N. Y.

Automatic production is almost a necessity for companies which must maintain tight quality standards in a competitive market. Management needs to be convinced that automation is economically sound and that it is possible.

Because of the present high cost of automatic production compared with that of human labor, automation is applied today primarily in two situations. One is in connection with engineer where the supply of the required type of human labor does not exist at any price. The other is for processes which it is literally impossible for human beings to control adequately, such as the production of radioisotopes and petroleum refining.

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TIME-SAVING FEATURES

Installing multiple convenience outlets is a real "snap" with Plugmold 2000 and Snapicoil! You *snap* the receptacles into the cover and *snap* the cover into the base—a few simple snap-over fittings complete the job! Takes minutes instead of hours.

Write today for new, free Plugmold 2000 book!

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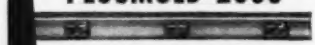

WIREMOLD'S *New* multi-outlet system

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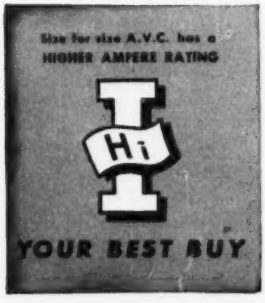
ROCKBESTOS A.V.C.® CARRIES 32% GREATER LOAD

YET BOTH ARE THE SAME SIZE

Compare A.V.C. with Type RH in a 250 MCM size*



- **you use 2½" conduit for both**
- **you use the same size fittings and lugs**
- **you have the same installation costs**
- **BUT Type RH carries only 224 amperes whereas higher-rated A.V.C. carries 296 amperes—a 32% increase in capacity.**

For more efficient current-carrying capacity, always specify Rockbestos A.V.C. Write for the booklet "Cut Current Carrying Costs."

*From Chapter X—National Electrical Code—3 conductors in conduit—40°C-104°F.

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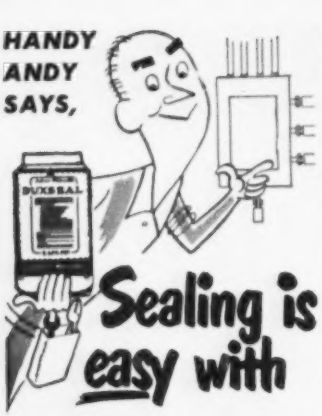
NEW YORK CLEVELAND DETROIT CHICAGO PITTSBURGH ST. LOUIS LOS ANGELES OAKLAND, CAL.



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DUXSEAL

the permanently plastic caulking compound

WATCH DUXSEAL* GO on as easy as putty right from the handy package. Watch it make a smooth, workmanlike job. Watch it provide a tight seal on duct openings, pot-heads, bushings, terminal boxes—and for filling multi-wire contact boxes indoors. You'll want a package in your tool box at all times for on-the-spot sealing.

4 more reasons why Duxseal is a favorite:

Stays plastic—Duxseal stays plastic indefinitely. Will not slump, melt or run under ordinary temperatures.

Stays tight—Clings to duct walls and cables but flexes with expansion and contraction of the cable.

Stays insoluble—Unaffected by ground waters and gases.

Stays harmless—Will not injure workmen's hands or react with rubber, metals or painted surfaces.

Tight seals for other electrical uses:

J-M Transeal . . . for use against refined oils employed in transformers, switches and similar equipment.

J-M Uniseal . . . for caulking equipment outdoors or in fume-laden areas. Resists temperatures up to 180° F.

If you would like to know more about Duxseal and other J-M labor-saving sealing compounds, write Johns-Manville, Box 60, New York 16, New York. In Canada, 199 Bay Street, Toronto, Ontario.

*Reg. U. S. Pat. Off.

JM

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SEALING COMPOUNDS

Six Fatal Accidents Delay Construction at Ross Plant

Partly as the result of six fatal accidents on the project, the first of three 90,000-kw units in the new Ross Power Plant of Seattle City Light will go on the line at least two weeks later than originally planned.

The original schedule called for the first power delivery Dec. 15. City Light now admits this schedule cannot be met. Custom on the Skagit project calls for a day off for everyone after a fatal accident. In addition, deliveries of equipment have been delayed.

After the sixth fatal accident, the State Department of Labor & Industries issued a new safety order, designed to prevent further loss of life.

Ed Sorger, state supervisor of safety, said a personal investigation revealed the basic cause of the loss of life was a "pressing schedule making it necessary to expose workmen to hazards to which they would otherwise and normally not be exposed." He said several jobs had been under way, one above the other, in the 200-ft shaft leading to the intake tunnel. Men on the lower levels were endangered by falling timbers or metal, he pointed out.

The sixth fatality resulted from a metal hook dislodging and falling 80 ft upon a workman. One portion of the new order prohibits such stacking of work crews.

NACA Wind Tunnel Load Will Be CEICo's Biggest

A new supersonic wind tunnel at National Advisory Committee on Aeronautics Laboratory at Cleveland will become Cleveland Electric Illuminating Co's biggest single power consumer in about a year.

The $32,856,000 project, largest of its kind in the world, will require 250,000 kw or more when operating at top speed. This is more than double the NACA lab's present requirements.

The main compressor in the new wind tunnel will be driven by four 37,500-hp motors on a common shaft. Three 33,000-hp motors, also on a common shaft, will spin the secondary compressor.

Earlier this year a 87,000-hp supersonic wind tunnel went into operation at the NACA lab (EW, Aug. 25, p 85).

CEICo's expansion program will take care of the added NACA load.

We Can Make
YOUR POLES
LAST LONGER
AND LONGER...
AND LONGER...
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WITH AN
OSMOSE
INSPECTION AND
TREATING PROGRAM
This program, performed by our highly skilled crews, can save your system hundreds of thousands of dollars in REPLACEMENT COSTS by
1. Absolutely arresting groundline decay of your poles and
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Treatment charge is as low as 4% of replacement costs and pole life is extended for approximately 8-10 years.
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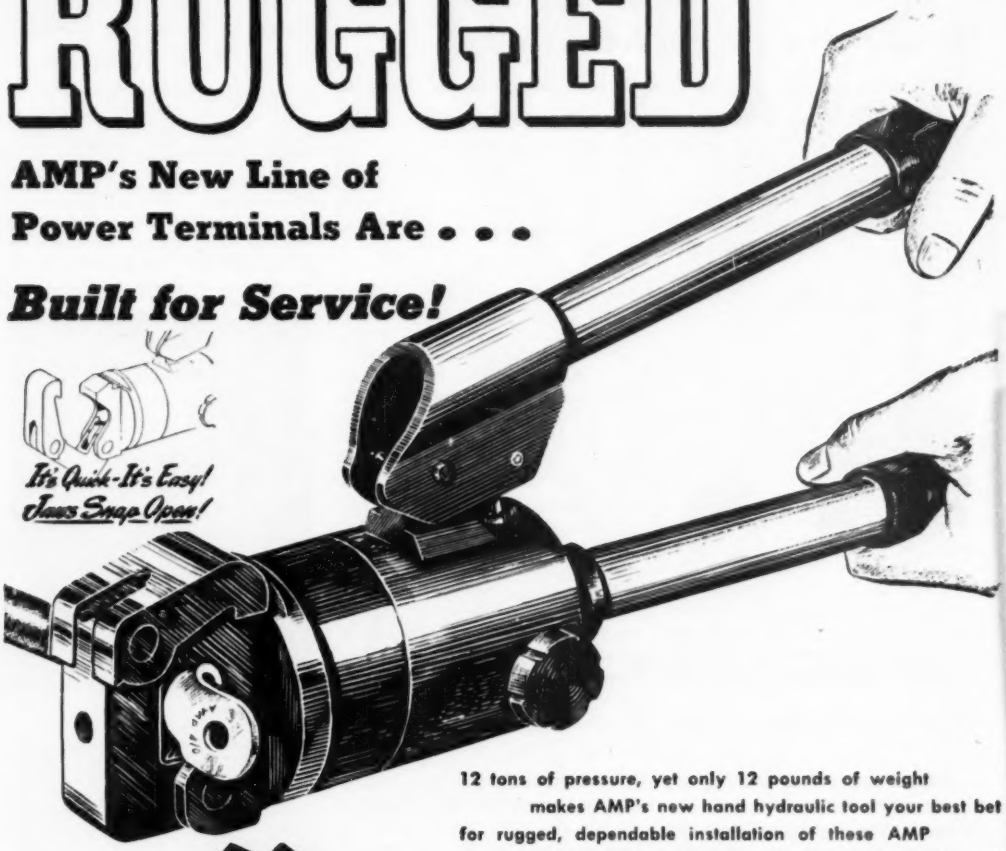
AMP's New Line of Power Terminals Are . . .

Built for Service!

It's Quick-It's Easy! Jaws Snap Open!



12 tons of pressure, yet only 12 pounds of weight makes AMP's new hand hydraulic tool your best bet for rugged, dependable installation of these AMP *precision-engineered* power terminals. Terminals and connectors are available in all ranges from #8 to #4/0. DESIGNED FOR USE ON ALL SHAPES OF WIRE: SOLID, STRANDED, SQUARE, OVAL, OR COMBINATIONS! Dies snap in and out easily. Tool automatically releases when crimping pressure is reached. Can be used with either pole strap or bench stand if desired. WRITE FOR SPECIAL POWER TERMINAL CATALOG.

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1200 Paxton Street, Harrisburg, Pa.

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Bruce Irvine Is Advanced . . .

. . . by Kentucky Utilities to system operating engineer. He goes to Lexington after serving in Dix Dam dispatching post

BRUCE IRVINE

Bruce Irvine, who has been in charge of dispatching at Dix Dam for Kentucky Utilities Co, has been promoted to the position system operating engineer of the utility.

To Direct State Operations . . . In his new position, Irvine will coordinate and schedule the production of the company's power plants throughout the state and the purchase, sale, and exchange of power through Kentucky Utilities' ten interconnections with neighboring electric systems. He will now make his headquarters at Lexington.

Irvine's new responsibilities are also to include scheduling the supply of KU's part of the construction and processing power for the power plants KU and other companies are building at Madison, Ind., Gallipolis, Ohio, and Joppa, Ill. These plants are being built to supply the electrical demands of the Atomic Energy Commission's Paducah and Portsmouth, Ohio, nuclear energy projects.

Went to Dix Dam in 1944 . . . Irvine worked for the utility in Lexington while attending the University of Kentucky College of Engineering and after his graduation in 1934. In 1937 he went to the division engineering department at Maysville and was transferred to Dix Dam in 1944. From 1947 until his recent promotion he filled the dispatching post at Dix Dam, which is the hub of Kentucky Utilities transmission network.

•

Richard D. Tyler has been named manager of marketing and **Thomas J. Kelly** manager of engineering for General Electric Co's appliance control department at Morrison, Ill. Formerly with GE's fractional horsepower motor department, Tyler will have overall responsibility for the sale and promotion of controls related to major appliances, air conditioning equipment, domestic heating systems, and special devices. Kelly, who joined GE 25 years ago, will be in charge of development and design of the department's products.

Merle W. DeWees has been appointed sales manager of the Ansonia Electrical Division of Noma Electric Corp, Ansonia, Conn. DeWees recently was executive director of the New Haven (Conn.) Taxpayers Council.

James R. Koch has been named Southern Division engineer for Pennsylvania Electric Co with headquarters at Johnstown and **W. R. McClure** has been appointed assistant division engineer with headquarters at Clearfield. Koch, who has been employed by Penelec and associated companies since 1924, has served as an analyst in the utility's rate department since 1946.

W. H. Merrifield has been advanced from assistant director of public relations to manager of information services for West Penn Power Co with the retirement of **Harold S. Metcalfe.** Merrifield, who joined West Penn in 1937, was named assistant to advertising manager in 1945 and appointed to the public-relations post in 1951. Metcalfe, with the utility since 1927, has been director of public relations and advertising manager for almost 26 years. He is a past president of the Public Utilities Advertising Association.

Beattie, Anderson Made VPs of H. K. Porter Co

With the merger of Delta-Star Electric Co, Chicago, into the parent company, H. K. Porter Co, Inc, Pittsburgh, C. S. Beattie and R. E. Anderson have been elected vice presidents of Porter.

Beattie formerly was executive vice president and general manager and Anderson senior vice president of the electric firm which will now be known

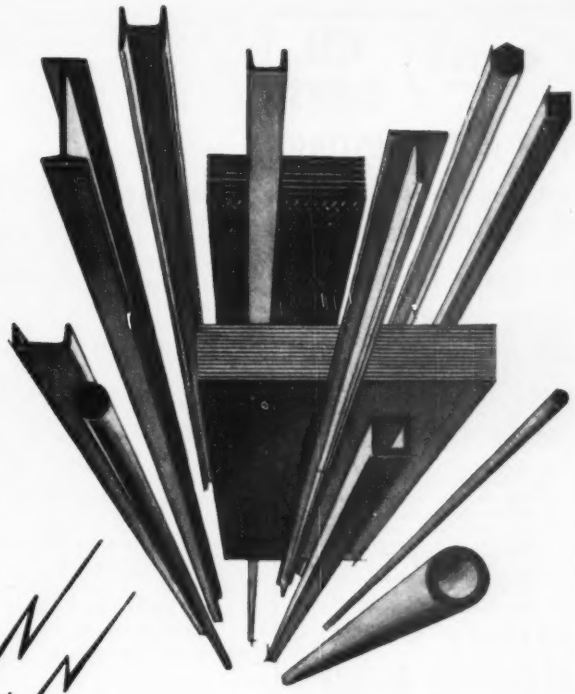
C. S. BEATTIE

R. E. ANDERSON

as the Delta-Star Electric Division. Policies, management, and operation of the unit will remain the same.

Division's Top Executive . . . Beattie, who will continue as general manager in charge of all division activities, joined Delta Star in 1930. He was made assistant sales manager in 1936

STEEL for UTILITIES



In stock...Prompt shipment

We carry a wide range of steel products in our 15 plants strategically located from coast to coast.

A good many kinds and sizes are in short supply at the present time, but we are still able to take care of most requirements.

So when you have any problem of steel procurement, application, or fabrication, we will be glad to work with you.

PRINCIPAL PRODUCTS

CARBON STEEL BARS—Hot rolled & cold finished
STRUCTURALS—Channels, angles, beams, etc.
PLATES—Many types including Inland 4-Way Safety Plate
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TUBING—Seamless & welded, mechanical & boiler tubes
ALLOYS—Hot rolled, cold finished, heat treated
STAINLESS—Allegheny bars, plates, sheets, tubes, etc.
REINFORCING—Bars & Accessories, spirals, wire mesh
BABBITT—Five types, also Ryertex plastic bearings
MACHINERY & TOOLS—For metal fabrication

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JOSEPH T. RYERSON & SON, INC. PLANTS: NEW YORK • BOSTON • PHILADELPHIA • DETROIT • CINCINNATI • CLEVELAND
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THE STATES COMPANY

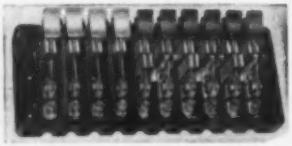
TEST BLOCKS

FOR METER TESTING

set the pace for

Easier Installation

Easier Testing



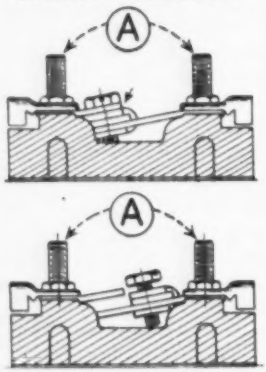
- No live parts extend beyond base, an important feature.
- Large selection of pole arrangements.
- Maximum pressure at jaw contacts.
- Angle bent studs permit quickly changing front connection blocks over to back connection. No detail is overlooked in the mechanical or electrical construction of these test blocks.

Specify STATES

TERMINAL BLOCKS

for quicker, easier, safer

CIRCUIT TESTING



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1. Just attach instrument to terminal posts.
2. Slide link out of contact—take reading.
3. Slide link back and bolt in position.

The States Company
3 New Park Avenue
Hartford, Conn.

Please send ☐ Test Block Catalog
☐ Terminal Blocks Catalog to

Name ..... Title .....

Firm .....

City ..... Zone ... State .....

and manager of engineering in 1941. In 1944 he was appointed vice president in charge of production and engineering and in 1951 was named executive vice president and general manager.

Before joining Delta-Star, Beattie worked for Westinghouse Electric Corp in the general engineering department at East Pittsburgh, for Public Service Production Co, Newark, N. J., and in the Switching Division of United Engineers & Constructors Co, Inc, also at Newark.

To Head Division's Sales . . . Anderson, who will be in charge of sales for the division, started with Delta-Star in 1920 as a sales engineer. He was appointed assistant sales manager in 1929, sales manager in 1936, vice president in 1941, and senior vice president of the manufacturing company in 1951.

Anderson started in Eastern Michigan Power Co's engineering department in 1913. After working with Commonwealth Edison Co for a year, he went to H. M. Byllesby Co in its engineering department in 1916.

•

W. F. Miller, comptroller of Washington Water Power Co for 22 years, has retired after 47 years of service.

J. David Wright, who has served as assistant manager of General Electric Co's industry engineering and sales department for the past two years, has retired. Prior to his appointment to the assistant manager's post in 1950, he was manager of the industrial engineering divisions for ten years.

Arthur H. Kuljian, chief mechanical engineer for Kuljian Corp, Philadelphia, has been elected vice president in charge of engineering. Kuljian, who has wide experience in the design and engineering of steam electric power stations and industrial plants in this country and abroad, has supervised such projects as Florida Power Corp's Higgins Plant at Booth Point, Fla., and the Palermo Steam Power Plant at Palermo, Sicily.

Raymon M. Eaton, superintendent and resident manager of Okonite Co's Hazard Insulated Wire Works Division at Wilkes-Barre, Pa., will retire Dec. 31. Eaton, who began with Okonite at Passaic, N. J., in 1909, has served in the present position for

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DO AWAY WITH GUY GUARD TROUBLES LIKE THIS . . .

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Flexibal

THE GUARD THAT CAN'T GO WRONG!

COSTS ⅓ LESS THAN METAL GUARDS—AND NO MAINTENANCE PROBLEM

FLEXIBAL Guy Guards — in standard lengths — provide the flexibility that gives with the blow and cushions the impact. Aluminum-painted, they offer both day and night visibility. No other type of guard is so easy to handle, so simple to install — none so effectively cut down losses — never gets out of commission.

USED AND PRAISED BY CONSTANTLY GROWING LIST OF UTILITIES

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IMMEDIATE DELIVERY

TEN COMPLETE SETS IN THIS ONE LIGHT EASY TO HANDLE CARTON

SEE YOUR JOBBER OR WRITE TO

S. E. OVERTON COMPANY

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Low-cost accuracy; neat and easy to install!

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Westinghouse Instrument Transformers offer you the most complete line in the Industry . . . each type and rating is designed for a specific need in metering or relaying applications. Your Westinghouse representative will help you select the right Instrument Transformer for your problem. Or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70632

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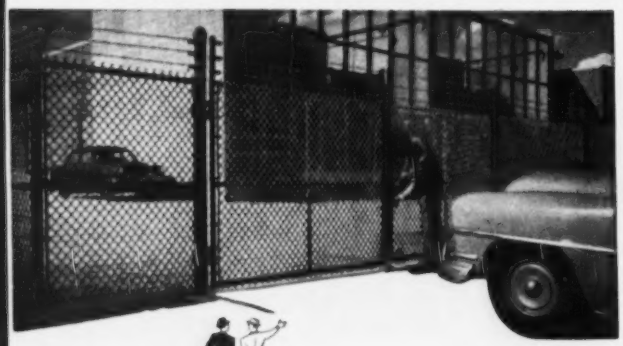

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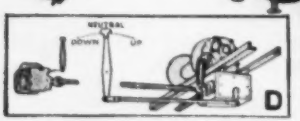

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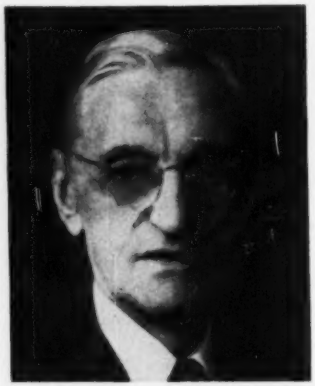
25 years. His successor as resident manager will be **David W. Nurse,** factory sales manager at Wilkes-Barre.

OBITUARY



Henry Holzapfel, Jr

Henry Holzapfel, Jr, 83, vice president of Potomac Edison Co, died at Hagerstown, Md., Nov. 22.

When Potomac Edison was established in 1923, Holzapfel, one of the founders of the utility, was named to the post of vice president. At the time of his death he also was vice president of the Blue Ridge Transportation Co, a subsidiary of Potomac Edison.

Washington Reed

Washington Reed, 61, vice president of Kentucky Utilities Co, died Nov. 30 at Lexington, Ky.

Reed, who graduated from Virginia Military Institute in 1912 with a de-

gree in electrical engineering, started with Kentucky Utilities in 1914 as an apprentice engineer, a position he held until 1916. For one year, from 1916 to 1917, he worked for the former Lexington Utilities Co as a lighting salesman.

During World War I he served as a lieutenant with the Army. Upon his return to Lexington Utilities, he filled various posts from 1919 to 1927 when he was made general manager. He was named vice president in 1929 and president in 1932.

Reed was president until 1940 when LU was merged with KU, at which time he was appointed KU vice president. However, prior to the merger, he had served Kentucky Utilities as vice president and as a director since 1936.

Lyman P. Hammond

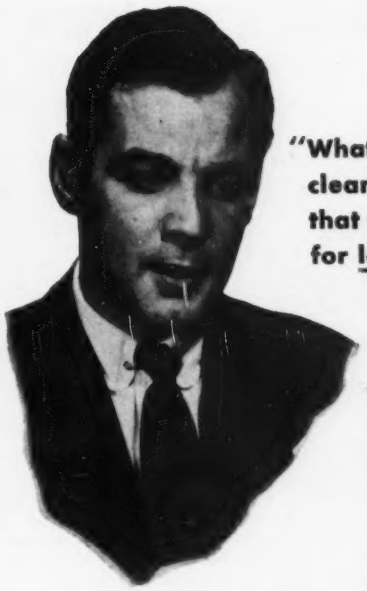
Lyman P. Hammond, 72, a former Electric Bond & Share Co executive, died Nov. 14.

Starting his utility career early in the century, Hammond became sales manager of the Colorado Power Co in 1910 and was president of the company when he resigned in 1924. In 1926 he went to Electric B&S, serving as a vice president from 1927 to 1935. He also served from 1931 until 1935 as a vice president of American & Foreign Power Co, Inc, an affiliate of Electric B&S.

From 1935 to 1939, Hammond was associated with Ebasco Services, Inc, a subsidiary of Electric B&S, as a sponsor in charge of American & Foreign Power's Mexican operations. He was elected a director of International Ebasco Corp in 1939 and a vice president of that firm in 1944. He retired from those posts in 1947.

William Parker, 65, manager of the Charlotte (N. C.) district of Allis-Chalmers Manufacturing Co's General Machinery Division since 1938, died Nov. 24. Associated with Allis-Chalmers since 1913, Parker had served as branch manager at Charlotte from 1930 until his appointment as district manager.

Clifford A. White, 80, former superintendent of the general service department of Boston Edison Co, died at Boston Nov. 11. In his earlier years with Boston Edison, he was head of the company's transportation department.



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ONE BIG BLAST breaks 100,000 tons of rock at Chile Exploration Co's open-pit mine at Chuquicamata, Chile. First shipment of blister copper derived from copper sulphide ore reserves of the mine has reached New York. Metal will be electrolytically refined by firm's subsidiary, the International Smelting & Refining Co's Raritan Copper Works at Perth Amboy, N. J.

Chile Taps Copper Sulphide

First shipment of blister from Chuquicamata reserves of Chile Exploration Co arrives in New York

Chile Exploration Co's first shipment of blister copper derived from copper sulphide ore reserves at its open-pit copper mine at Chuquicamata arrived recently in New York aboard the Grace liner Santa Cecilia.

Unit Started in 1948 . . . The blister copper was produced at the company's new copper concentrator and smelter, which has been under construction since late 1948. According to C. F. Kelley, board chairman of Anaconda Copper Mining Co, parent organization of the Chile company, the new sulphide plant is being placed in operation and that the first blister copper was produced from the smelter on Nov. 5.

Until now, copper production has been derived from oxide type ores which were treated by leaching and electrolyzing. The blister copper now being produced from sulphide ores at the new Chuquicamata plant will be electrolytically refined by the company's subsidiary, International Smelting & Refining Co's Raritan Copper Works which is located at Perth Amboy, N. J.

The new sulphide plant at Chuquicamata, together with the oxide plant which will continue in operation, is expected to attain an ultimate combined capacity of not less than 500 million lb of copper per year.

Refined Copper Stocks Decrease During October

Stocks of refined copper held in the United States by members of the Copper Institute, Inc, at the end of October totaled 59,760 tons, a decrease of 11,696 tons below the 71,456 tons held on Sept. 30.

During October deliveries to domestic fabricators increased to 136,964 tons compared with deliveries of 135,486 in September. Refined production rose to 105,770 tons from 98,930.

Outside the United States refined stocks amounted to 143,872 tons on Oct. 31, a drop of 13,578 tons below the 157,450 tons on Sept. 30. October deliveries increased to 85,754 tons from 83,784 in September and refined production was 90,720 tons compared with 96,511.

Westinghouse Units Slated for Iceland Power Plants

Westinghouse Electric Corp will supply two major hydro electric power plants in Iceland with generators capable of producing nearly 41,000 kw. The projects, now under construction at Sogsvirkjun and Laxavirkjun, are scheduled for completion late next spring.

Located at Iru Falls on the Sog River, the Sogsvirkjun station will provide electric power for householders in the capital city of Reykjavik, some 32 miles away, as well as power for a 6,000 ton-a-year nitrogen phosphate fertilizer plant now being built in that city.

The Laxavirkjun station is being built at Bruar Falls on the Laxa River in the northeastern section of the country. An 8,600-kw generating unit there will supply power to Akureyri, an important textile and fishing center.

At Sogsvirkjun, two Westinghouse 15,650-kw water-wheel generators will be housed 115 ft underground. Water for the turbines will flow through two natural penstocks cut vertically in lava rock. After leaving the turbines, the water will pass through a channel cut beneath the river and discharge downstream.

Welds on the steel penstocks for the new Laxa station are being inspected with the aid of a 150-kv Westinghouse industrial radiographic X-ray unit, which later will be turned over to a hospital in Akureyri for superficial therapy work.

These two new power plants will furnish electric power which is in demand by Iceland's housewives because of the lack of wood and coal on the island.

British Electric Firms Underbid U. S. Suppliers

Two British companies have underbid American competitors for large electrical equipment for the Chief Joseph Dam on the Columbia River in north central Washington. The bids are to be reviewed before awards will be made, the Seattle District Army Corps of Engineers has announced.

English Electric Co, Stafford, England, has submitted a low bid of $1,831,880 to the Corps of Engineers for furnishing ten 103,300-kva transfor-

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with ONE grounding clamp instead of MANY

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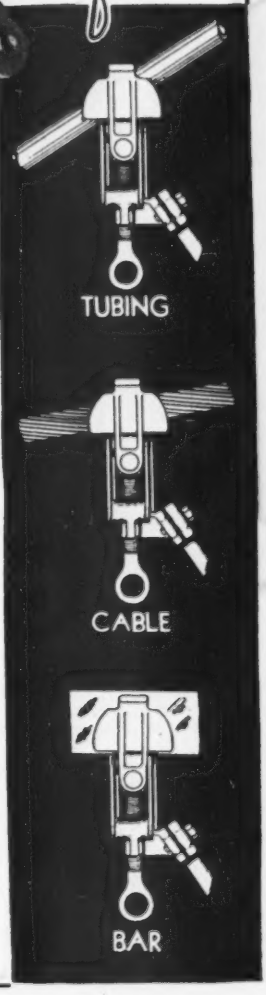

MEMCO "VERSI-TAP" CLAMPS CAN BE USED *AT ANY ANGLE* ON ALL CONDUCTOR SHAPES

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MEMCO ENGINEERING & MANUFACTURING CO., Inc.
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mers. Nearest American firm in the bidding was Moloney Electric Co, St. Louis, at $2,203,798.

English Electric Export & Trading Co, Ltd, New York, apparently was low bidder for four alternating current generators. The firm's bid was $4,406,493 compared with the bid of $4,966,363 submitted by Westinghouse Electric Co, the next lowest of five bids.

MANUFACTURING BRIEFS

Baldwin-Lima Hamilton Corp, Philadelphia, was the lowest of four bidders for manufacture and delivery of hydraulic turbines for The Dalles Dam powerhouse when offers were opened recently by the Portland District of Army Corps of Engineers. Low bid was $20,025,770 for 14 123,800 hp turbines and $8,683,850 for six turbines. Col T. A. Liscomb announced he has requested authority to award contracts on the basis of 14 units instead of six in order to bring down average per unit cost.

Riley Stoker Corp, Worcester, Mass., has concluded an agreement with John Brown & Co, Ltd, Sheffield, England, whereby Riley steam generating and fuel burning equipment will be manufactured by Brown in Great Britain for use in various parts of the world. Under this arrangement, which also provides an interchange of engineering data, Riley equipment is made available for purchase with sterling funds in dollar-short areas.

FINANCIAL NOTES

Federal Electric Products Co's new offering of 225,000 shares of common stock at $5.25 has been completely sold out, H. M. Byllesby & Co, New York underwriter, has announced. The Newark, N. J., firm will use the proceeds to acquire all of the outstanding Powerlite Switchboard Co's capital stock and for general corporation purposes.

Square D Co, Detroit, will pay Dec. 31 a regular quarterly common dividend of 35¢ a share and an extra of 65¢ a share. This will make total payments of $2.05 in 1952 as compared with $2.25 in 1951 when 85¢ a share extra was paid.

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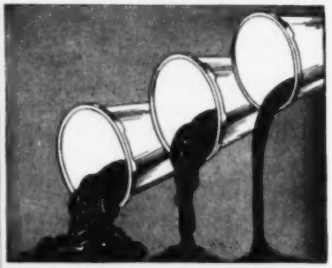

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New Electrical Construction

New electrical construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included.

UTILITIES

Proposed Construction

California — Bureau Reclamation, Dpt. Interior, Bldg. 53, Denver Federal Center, Denver, Colo., furnishing steel structures for transformer circuits and switchyard at Folsom Power Plant and transformer structures at Nimbus Power Plant for Folsom Unit, American River Div., Central Valley Proj., Spec. DS 3848.

Calif., El Centro—Imperial Irrigation Dist., El Centro, Pilot Knob Hydro-Electric Plant and related projects on All-American Canal, $6,500,000. B. A. Weiss, c/o owner, engr.

Calif., Inyokern—Dpt. Navy, Naval Ordnance Test Station, Inyokern, China Lake, electric power system, extensions, imprvs., NOY 76652. Spec. 37359, $400,000.

Conn., Bridgeport—General Electric Co., Boston Ave. and Bond St., 99,000 sq. ft. plant addn., Bond St., $3,000,000.

Ind., Evansville—WFBM Inc., 1330 N. Meridian St., Indianapolis, Zone 2, television station, $683,000. Gillett & Bergquist, National Press Bldg., Wash., D. C., consult. engrs.

Ind., Peru—City, imprv. water cooling sys., etc. power plant, $151,000. Pfeifer & Schultz Co., Wesley Temple Bldg., Minneapolis, Minn., consult. engrs.

Kan., Norton — Norton-Decatur Co-operative Electric Co., Norton, warehouse, shop, with offices, $100,000.

La., New Orleans—Times-Picayune Pub. Co., (WTPS), 601 North St., television station, $584,000. Millard M. Garrison, 1519 Connecticut Ave. N.W., Wash., D. C., consult. engr.

Maryland—Choptank Electric Co-operative, Denton, 177 mi. rural distr. lines, Caroline Co. Plans deposit $10. B. O. Yannort Engineers, Inc., 700 S. College St., Charlotte, N. C., engr.

Minnesota—Meeker Co-operative Light & Power Assoc., Litchfield, 41 mi. rural distr. lines, sys. imprvs., Meeker Co. $460,-000.

Mo., Independence—City, c/o Robt. B. Waddell, city engr., enlargement of 5,000-10,000 KW. city power plant. Black & Veatch, 4706 Broadway, Kansas City, Mo., consult. engrs.

Montana—Bureau Reclamation, Dpt. Interior, Bldg. 53, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars Tiber for carload shipments and Chester for LCL shipments at option of bidder, outdoor power transformer, with tank-mounted lightning arresters for Tiber Switchyard, Marias Div., Lower Marias Unit, Missouri River Basin Proj., Spec. DS 3847.

Nebraska—York County Rural Public Power Dist., York, 130 mi. rural distr. lines, Clay, Fillmore, Hamilton and York Counties, $175,000. Henningson, Durham & Richardson, Standard Oil Bldg., Omaha, consult. engrs.

New Mexico—Otero County Electric Co-operative, Cloudcroft, 70 mi. rural distr. lines and sys. imprvs., Otero Co. $185,000.

North Dakota and South Dakota—Dickey Rural Telephone Mutual Aid Corp., Ellendale, 474.11 mi. rural distr. lines, McIntosh, Dickey, Logan and LaMoure Counties, N. D. and Brown and McPherson Counties, S. D. Extended date. Ulteig Eng. Corp., 1114½ Front St., Fargo, N. D., engrs.

North Dakota—U. S. Eng., Fort Lincoln, P. O. Box 300, Bismarck, powerhouse, switchyard, Garrison Dam and Reservoir Proj., in Twp. 146 N., Range 84 W. Mercer Co., on Missouri River approx. 75 mi. northwest of Bismarck, 65 mi. southwest of Minot, 3 mi. west of Riverdale, CIVENG 32-015-53-19.

Ohio—Cleveland Electric Illuminating Co., Public Square, Cleveland, electric power distr. sub-stations to link with Eastlake, O., Mentor Twp., $515,000; In Concord Twp. to link with Eastlake, $150,-

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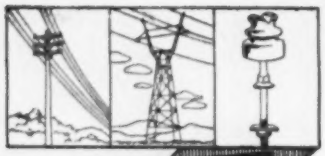

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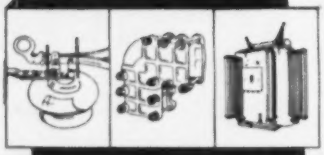

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900; electric power transmission sub-station, connecting to 132,000 volt steel-tower transmission sys., in Fairport to link with Eastlake. $1,700,000.

O., Columbus—State Dpt. P. Welfare, 795 Ohio Depts. Bldg., power plant repairs, equip and service units, piping, Columbus State Hospital. Plans deposit $5. Sims, Cornelius & Schooley, 2901 N. High St., archts.-engrs. H. G. Allen, c/o owner, archt.

Oklahoma—Western Electric Co-operative, Anadarko, 73 mi. 69 kva lines and sub-station, Anadarko, Caddo Co. $1,367,000. C. H. Guernsey & Co., 2701 N. Oklahoma St., Oklahoma City, consult engrs.

Pa., Pittsburgh—Western Electric Co., Inc., 310 River Ave., 2 story, brick, concrete warehouse and repair plant. $360,000.

South Dakota—Condenser—B.A. 1/8—Bureau Reclamation Dpt. Interior, Bldg. 53, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars Rapid City, one 10,000-kva, 4,160-volt, 3-phase, 60-cycle air-cooled outdoor-type synchronous condenser with starting auto-transformer and with control equip. for Rapid City Sub-station, Transmission Div., Missouri River Basin Proj., Inv. No. DS-3850.

S. D., Rapid City—U. S. Eng., 1609 Jackson St., Omaha, Neb., electric power supply, Rapid City Air Force Base, Inv. 25-066-53-41.

Texas—San Bernard Electric Co-operative, Bellville, 95 mi. electric distr. lines, 39 mi. transmission line and sys. imprvs., Austin Co. $690,000.

Va., Yorktown—P. Wks. Office, Headquarters, Fifth Naval Dist., U. S. Naval Base, Norfolk, Zone 11, installing 300 kw generating unit at U. S. Naval Schools (Mine Warfare), NOY 75731, Spec. 36498. Plans deposit $10.

Wash., Everett—U. S. Eng., 4735 E. Marginal Way, Seattle, Zone 4, 11¼x15½ ft. frame emergency power house, concrete fdn., 8x10 ft. concrete fdn. for shelter, foundation piers for 3 masts, etc., for THF/TIP facilities, Paine Air Force Base, Inv. 53-70.

Low Bidders & Contracts Awarded

South Dakota—R. N. Campsey Constr. Co., & C. F. Lyte Co., 2238 Oneida St., Denver, Colo. CA $508,432, est. $580,446, constr. Gahe-Midland 115 KV transmission line, Transmission Div., Missouri River Basin Proj., Spec. DC 3781, Bureau Reclamation, Dpt. Interior, Huron, S. D. Bids Oct. 2, awarded Nov. 21.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Ga., Decatur—De Kalb Co. Bd. Revenues, County Office Bldg., Decatur, plans by Stevens & Wilkinson, 157 Luckie St. N.W., Atlanta, warehouse for lease to various firms $12,000,000.

Ill., Chicago—Continental Assurance Co. 310 S. Michigan Ave., Zone 4, office building group 3 units, 1 square block St. Clair St., Fairbanks Court, Erie St. and Huron St. $30,000,000.

Pa., Fallsington—Delpen Realty Corp., c/o Harry Thoens, Inc., 233 Broadway, New York 17, N. Y. plans by Morris Landus, 256 E. 49 St., New York 17, N. Y., shopping center, on 44 acre site on Lincoln Hy. near here to be called Falls Shopping Center. $6,000,000.

Low Bidders & Contracts Awarded

Colo., Denver—Webb & Knapp Constr. Co., 270 Park Ave., New York 17, N. Y., CA, approx. $15,000,000, 22 story office, Broadway from 17 to Lincoln Sts. Ritz Carlton Realty Co., c/o contractor, Cleoh Ming Pei, c/o contractor, archt.

D. C., Wash.—Morris Cafritz, 1404 K St. N. W., and Charles H. Tompkins, 907 16 St. N. W., Wash., D. C. Own Forces, $26,000,000, community of offices, apartments, shops and hotels, Florida and Connecticut Aves. 19 St. and Columbia Rd. N. W., 1st unit. Park at Your Desk Office Bldg., $8,000,000; 2nd unit office, $4,000,000; 3rd unit hotel, $9,000,000; 4th unit apartment, $5,000,000. Roy L. Werner, 1404 K St., N.W., Wash., D. C., archt.

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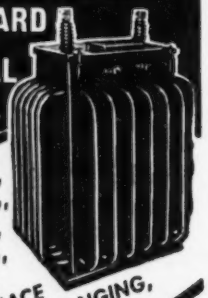

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● **VERTICAL PUMPS:** Conduction features of small vertical pumps for sidewall or submerged mounting are described in a new 8 pg bulletin that is now available. Units are covered in capacities to 250 gallons per minute at heads to 125 ft for coolant circulating and air conditioning. Copies of Bulletin 57B6975A may be obtained on request from Allis Chalmers Manufacturing Co, 932 S 70 St, Milwaukee, Wisc.

● **HEAVY DUTY REEL:** A new booklet showing the use of HyKon heavy duty reels has been released recently and is ready for distribution. These reels are designed for handling drop wire, large bulky coils and all around use. Available to the trade on request to HyKon Manufacturing Co, 163 E State St, Alliance, Ohio.

● **RACEWAYS AND FITTING:** Full information on surface metal raceways and fittings for electric light power and telephone is included in a new issue of Catalog and Wiring Guide No 19 being distributed by the Wiremold Co, Hartford Conn. Also contained is complete data on 2000 Plugmold. Copie are available.

● **GE HOOK-ON INSTRUMENTS:** A new 8 pg booklet describing General Electric's complete line of hook-on instruments has been announced as available from the company. Designated GE-901 it shows applications, operation and basic features of the AK-1A bolt ammeter; AK-2 wattmeter and the AK-3 power factor meter. For copies write the company at Schenectady 5, N. Y.

● **REFERENCE GUIDE:** A socket catalog No 800 has been released by Unistrut Products Co, 1013 Washington Blvd, Chicago 7, Ill. It will be of particular use to architects, engineers, draftsmen, contractors, distributors and workers on the job or, anyone concerned with the use specification or purchase of Unistrut all purpose framing.

● **CABLE BOXES:** A comprehensive listing of cable boxes for splicing, for solid, link or fuse connection of underground cables is contained in a new bulletin No BA52. For further information write the G&W Electric Specialty Co, 7780 Dante Ave, Chicago, Ill.

● **PRINTING PRESS DRIVES:** A new bulletin describing press drives for commercial printers has been announced as available from the General Electric Co, Schenectady 5, N. Y. It covers design features and application of the new GE ac preset speed press drive with ratings up to 15 hp. Illustrated, it may be had upon request. Write for GEA-5702.

● **METERING APPLICATIONS:** A 20 pg booklet on metering applications for watthour meters has been announced by the General Electric Co, Schenectady 5, N. Y. Called GET-1905 it includes circuit wiring diagrams and descriptions of watthour meter constants and register data. Write for copies.

● **TWO-WAY RADIO:** A new 8 pg illustrated booklet discussing the use of two way radio for better coordination of new materials and machines. Titled "Instant Communication," it is slanted to businesses using materials handling and emergency service. Copies will be sent free on request to the Advertising Inquiry Section, General Electric Co, Electronics Park, Syracuse, N. Y.

● **COSTING RESINS:** A new industrial technique, embedding electrical components in "Scotchcast" brand electrical insulating resins is decribed in an 8-pg, illustrated booklet available on request from Minnesota Mining and Manufactur-

Surplus Show Opens

The Second Annual Trade Show and Convention of the Institute of Surplus Dealers will be held January 6th to 8th, 1953 at the Hotel Statler, New York. Eugene P. Connolly, president of the Institute, said the Show will include goods estimated at more than $100,000,000.

The Show promises to exceed the records set last year in volume of business as well as attendance. In addition to mechanical, electrical and electronic devices, tools, metals, etc., exhibitors will include leading firms in new, used and reconditioned machinery and tools.

One of the most important categories will be electronic parts and equipment. A careful estimate of such goods to be offered indicates an inventory of $10,000,000. This figure represents the offering prices which would be a fraction of replacement cost. Materials for sale represent Army, Navy and Air Force surplus as well as increasing amounts of industrial electronic surplus arising from changes in production and new products. At the show last year, sales in this field ran to substantial volume and it is expected sales this year will be higher.

The Institute of Surplus Dealers is a national organization of dealers in surplus materials of all descriptions. Last year's show had a record-breaking attendance of 5,000 from all over the world. Admission is free.

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1953 JANUARY 7 WEDNESDAY

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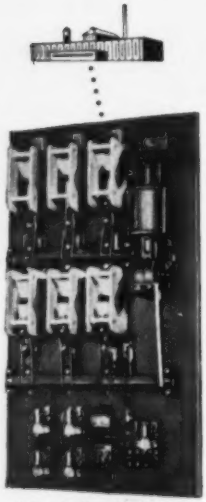

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ing Co, 900 Fauquier St, St. Paul, Minn. Applications for both "Scotchcast" resin No 1 (hot pouring) and "Scotchcast" resin No 2 (cold pouring) are given, the use of fillers to obtain special characteristics is discussed, and casting techniques are outlined briefly. Copies available.

● **CARBIDE ALLOYS:** A new 32 pg brochure published by the Allegheny Ludlum Steel Corp, 2020 Oliver Bldg, Pittsburgh 2, Pa., contains the most recent information on new Cormet production techniques as well as new applications of this metal. Free copies are obtainable upon request from the Advertising Dept of the company.

● **CABLE TROUGH:** Bulletin 65-A is a 12 pg catalog which describes with drawings and photographs the complete line of expanded metal cable trough. It shows how this cable trough can be used advantageously in supporting power and control cable. It contains a section on tracing templates which includes frame type drop out, conduit bushing drop out and load deflection data. Copies are available from T. J. Cope, Inc., 711 South 50 St, Philadelphia, Pa.

● **SERVICE STATION LIGHTING:** Catalog No 52, a fully illustrated, free, 32 pg brochure covering service station lighting equipment has just been published by Guardian Light Co, Oak Park, Ill. Photographs, drawings, technical data and general information is included. For further information write the company at the above address.

● **COMPRESSORS:** A comprehensive bulletin has just been released for distribution by the Cooper Bessemer Corp, Mt Vernon, Ohio. This 44 pg engineering type catalog provides basic application data with design specifications. Write on your letterhead to Dept M-6 for Bulletin No M-70.

● **ELECTRICAL DEMONSTRATIONS:** Twenty-five electrical demonstrations that can easily be performed are described in a new 32 pg booklet available from Westinghouse Electric Corp, School Service Dept T, Box 2278, Pittsburgh 30, Pa. It is designed primarily for use in rural educational programs. Sample copy will be sent upon request.

● **DIESEL, DUOFUEL SPARK-FIRED GAS ENGINES:** The Nordberg Manufacturing Co, Milwaukee, Wisc, has announced the availability of a new bulletin No 205. It illustrates and describes Nordberg four cycle 9" and 13" diesel, duofuel and spark fired gas engines.

● **CHEMICAL EXTINGUISHER:** A 2 pg bulletin describing the new fast flowing dry chemical extinguisher Redi Flo has been issued by Stop Fire, 125 Ashland Place, Brooklyn, New York. It explains fully this nitrogen pressurized unit developed to insure free non clogging dry chemical discharge. Write for Bulletin SF 1001.

● **MARKING TOOLS**—Over 100 different marking tools and devices are described and illustrated in a new 28 pg catalog recently published by the M. E. Cunningham Co, 1090 Chateau St, Pittsburgh, Pa. Photos, catalog numbers and charts are included. Copies of this catalog No 100 may be obtained from the company.

● **MOTORS BULLETIN** NO 100, a new 4 Og 8½ x 11" illustrated folder has just been announced as available by the Doerr Electric Corp, Cedarburg, Wisc. It covers special application designs for pump, brake, power tool, hoist fan motors and motor parts for built-in drives. It is free upon request to the company.

● **TIME-CYCLE CONTROLLER**—Publication of a 12 pg bulletin describing a line of time cycle controllers has just been announced by the Bristol Co, Waterbury 20, Conn. Information is given.

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DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-3350) will be received at Denver, Colorado, until January 8, 1953, for furnishing one, 10,000-kva, 4,160-volt, 3-phase, 60-cycle, air-cooled, outdoor-type synchronous condenser, with starting and control equipment for Rapid City Substation, South Dakota, Missouri River Basin Project. Delivery is desired within 540 days. For particulars, address Bureau of Reclamation, Building 53, Denver, Federal Center, Denver, Colorado.

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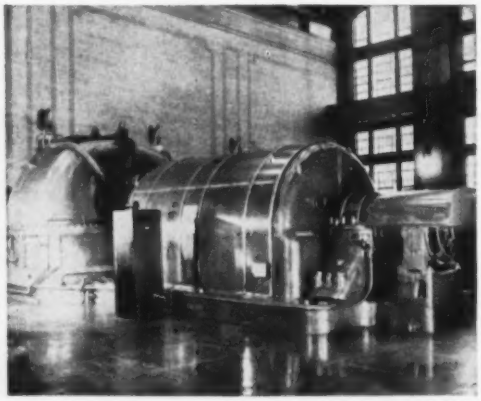
The Power Production Department of The Dayton Power and Light Company invites your inquiry for complete information and performance data on this 25,000 KVAM—20,000 KW, 80% P.F., 3 phase 60 cycle, 13,200 volts, 1800 RPM General Electric Company turbine generating unit. 200—213 P.S.I.G., 540 total temperature, complete with direct connected shaft exciter, switchboard and instruments. Includes 30,000 sq. ft. 2-pass Westinghouse surface condenser, motor-driven and turbine-driven pumps and condenser auxiliaries. All in excellent condition.



Ready for immediate delivery and speedy production of the power you need

The Dayton Power and Light Company

DAYTON, OHIO, U. S. A.

SUBSTATION EQUIPMENT

TRANSFORMERS

Qu.	KVA	MFR.	VOLTAGE
4	500	Pitts.	66000/32000—13200/23000 Y
4	500	West.	69000—[illegible]
3	200	Pitts.	66000—2300
3	75	A. C.	66000/24000—7200/12470 Y
3	200	A. C.	45000—2400/7200
4	150	West.	44000—33000—2300/6900
3	100	G. E.	44000—2300
3	75	West.	44000—7200/12470 Y
6	25	G. E.	44000/22000—2300/480
4	5000	G. E.	40583/70900 Y—14500
3	5000	G. E.	38100/66000—6600
1	18750	A.B.B.	34840—11000, 3 ph.
2	5000	West.	33000—26400/13200, 3 ph.
3	200	A. C.	34500—2400/7200/12470 Y
4	200	G. E.	34500—230/460
3	100	West.	33000—240/480 NEW
3	100	A. C.	33000—7200/12470 Y
3	75	Wag.	33000—7200/12470 Y
6	2125	G. E.	26400/13200—2300
4	1500	A. C.	25400/44000 Y—6900/12800
4	450	A. C.	25410/44000—13280/23000
6	100	G. E.	22000—7200/12470 Y
9	50	G. E.	22000—2300
1	4000	Mol.	13800—660, 3 ph.
1	450	Penna.	13200—2400, 3 ph. ASKAREL
3	200	G. E.	13800—2300
1	3750	G. E.	11000—2300, 3 ph.
4	750	G. E.	11000—440
3	500	Mol.	7200/12470 Y—2400/4160 Y
3	250	Pitts.	7200—230/440
3	150	Wag.	6900—2300
3	37½	G. E.	6900—230/460
2	100	G. E.	4800/2400—480/240
3	1500	A. C.	2300/4000 Y—2300
1	100	G. E.	2300—575, 3 ph.
6	50	West.	2400—114/228, DRY TYPE

INDUCT. REGULATORS—OUTDOOR

1—140 KVA G. E. 200 A. 4000 V. 3 ph.
4—50 KVA West. 250/500 A. 2400 V. 1 ph.
6—48 KVA G. E. 200 A. 2400 V. 1 ph.
8—36 KVA West. 150/300 A. 2400 V. 1 ph.
2—36 KVA G. E. 75/150 A. 4800 V. 1 ph.

CIRCUIT BREAKERS

1—600 A. 73 KV G. E. FHKO-236-500 MVA
1—400 A. 37 KV G. E. FHKO-236-500 MVA
1—1200 A. 15 KV G. E. FKO-139-350 MVA
4—600 A. 15 KV G. E. FHKO-139-750 MVA
1—600 A. 15 KV G. E. FHKO-136-250 MVA
1—400 A. 15 KV. G. E. FHKO-136-350 MVA

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Units of Every Size and Description

TRANSFORMERS

KVA	Make	Ph.	Pri.	Secondary
1000	Westgh.	3	4800	480
550	Westgh.	3	4160	455
667	G.E.	1	33000	480
333	A.C.	1	14400	240/480
300	G.E.	3	13800	240/480
300	G.E.	3	2400	240/480
200	Wagner	1	2400	575
167	A.C.	1	2400	120/240
100	Pitts.	1	2400	575
100	A.C.	1	2400	120/240

ENG. GENERATOR SETS

KVA	Make	Type	Volts	Speed
300	Gen. Motors	8-268A	480	1200
100	Gen. Motors	6-71EC	480	1200
100	Gen. Motors	3-268A	480	1200
31	Cummins-Rogers	H-1-6	120/208	1200
25	LeRoi	20-A	120	900

M. G. SETS

K.W.	Make	A.C.	D.C.
2400	A.C. (3-unit)	4800	525
2400	West. (3-unit)	4800	600
2000	G.E. (3-unit)	11000	137½/275
1000	West. (3-unit)	11000	137½/275
500	A.C.-Westgh.	2300	250
500	Cr.-Wh.	220/440	250
450	G.E. (3-unit)	2300	125/250
400	A.C.	2300	120/240
250	Westgh.-G.E.	440	250
200	Ridgeway	2200	250
150	G.E.	2300/440	250
150	G.E.	2300/4000	125/250
150	G.E.	440	275
100	G.E. (25 cy)	440	125
100	G.E.	2300	250
100	Delco-GE	440	120/240
90	G.E.	440	60
75	A.C.	440	250
60	A.C.	2300	110
60	G.E.	440	250
40	Cr.-Wh.	220	125
40	A.C.	220	125
40	G.E.	220	125
35	G.E.	440	125
25	Westgh.	2200	125

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CHICAGO *Electric Co*

1324 W. CERMAK ROAD

CHICAGO 8, ILL.

FROM AVAILABLE STOCK

TURBO GENERATORS
IN STOCK

Qu.	KW	Make	
1—	1000	G.E.	Non-Cond—190 lbs—2400-3-60
1—	1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1—	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1—	500	Moore	Non-Cond—150/200 lbs., & 35 lbs. B.P., 480-3-60 Dir. Conn. Exciter
1—	400	Westgh.	Non-Cond.—125/150 lbs., & 10 lbs. B.P., 240/480-3-60
1—	300	G.E.	Non-Cond.—150/175 lbs., & 10 lbs. B.P., 480-3-60

FREQUENCY CHANGERS

KVA	Make	RPM	Voltages	Frequency
1—3750	G.E.	900	2400/4150-2400/4150	25/60/25
1—3125	G.E.	300	2400/4150-2400/4150	25/60/25
2—2000	G.E.	750	2400/4150-2400/4150	25/63½/60/24

MOTOR GENERATOR SETS
3 ph. 60 cy.

Qu.	KW	Make	Speed	DC Volts	AC Volts
1—	2000	G.E.	514	600	6600/12300
2—	2000	G.E.	600	250	25 cy. 11000
1—	1500	G.E.	720	600	12300
1—	1500	G.E.	360	275	2300/4400
3—	1500	G.E.	514	250	6600/12300
3—	1500	G.E.	60	600	2300/4150
1—	1000	G.E.	900	300	4100/6900
2—	1000	Whse.	900	600	2300/4150
1—	500	Whse.	900	250	6600/12300
1—	500	Whse.	1200	125/250	2300
1—	500	Whse.	900	250	440
1—	500	G.E.	720	125	2300
1—	400	G.E.	720	250	440/2300
1—	350	G.E.	900	125	4150
1—	150	G.E.	1200	275	2300
1—	150	Whse.	1200	275	2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
3—1250	G.E.	HVDDJ		6600x550
1—1150	A.C.	OBSC		13200x480/2400
2—1000	G.E.	HVDDJ	1	2200x480
9—	300	G.E.	HT	3	2400x240/480

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A.C.—50 AND 60 CYCLES

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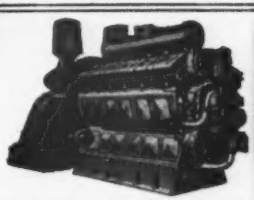

A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1500	Fairbanks Morse	32E16	2000	300	320	Buckeye	80	480	600
1136	Fairbanks Morse	38D	1600	720	320	Enterprise	DSO-6	560	450
1100	General Motors	16-278A	1800	720	300	General Motors	8-268A	450	1200
1000	General Motors	16-567B	1440	720	250	Fairbanks Morse	37-F	375	360
750	General Motors	12-567	1080	720	200	General Motors	6-268A	300	1800
600	Baldwin	VO-6	750	514	100	Worthington	BD-6	150	600
500	General Motors	8-278A	720	720	100	General Motors	3-268A	150	1200
500	General Motors	8-567	720	720	60	General Motors	6-71	90	1800
500	Ingersoll-Rand	6-P	600	720	30	International Harvester	UD-14	45	1200
500	Baldwin	VO-4	510	450					

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180 P.S.I.—535°F Total Temp.

3 phase 60 cycle 2300 volt

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TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4150V, 2300V Pyranol
2— 750 KVA G.E., 3 Ph., 4150V, 120/240V, sec.
2— 400 KVA Pitts., 1 Ph., 2400/4800V, 240/480V.
3— 333 KVA Whse., 1 Ph., 2400V, 600 V sec.
2— 200 KVA G.E., 3 Ph., 4150V, 120/240V. sec.
1— 200 KVA G.E., 3 Ph., 2400-220 Sec.
3— 100 KVA Whse., 1 Ph., 13,200V—220/440.

SYNCHRONOUS MOTORS

1— 300 H.P., Elec. Mach., 720 RPM, 3 Phase 60 cyc., 2200V T. E. F. Cooled Outdoor service.
1— 150 H.P., G. E., 1800 RPM, 220V, 3/60
2— 150 H.P., Al. Chal. 360 RPM, 440V, 3/60

MOTOR GENERATOR SETS

1—1000 KW G.E., 600 V, 514 RPM, 4000V Syn.
1— 200 KW Whse., 275V, 900 R.P.M., 220 V Syn.
1— 176 KVA West., 1Ph., 220V, Motor 3Ph., 440V.
1— 150 KW G.E., 125/250V, 1200 RPM, 2300 Syn.
1— 100 KW G.E., 250V, 900 RPM, 2300V, Syn.
1— 75 KW C.W., 250V, 1200 RPM, 2300/4150 Syn.

SLIP RING MOTORS

1— 400 H.P. West. CW, 450 RPM 550V.
1— 250 H.P., West., CW, 600 RPM, 440V.
1— 200 H.P., West., CW, 600 RPM, 440V.
3— 150 H.P., Al, Ch. 1800 RPM, 2300V., 3Ph. 60Cy.
1— 100 H.P. G.E., MT 600 RPM 440V.

Large Stock of A.C. and D.C. Equipment

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We rewind, repair and redesign all makes and sizes. One Year Guarantee.

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UPGRADING INDUSTRY'S LIGHTING STANDARDS

Wheeler
"DAY-FLO UPLITER"
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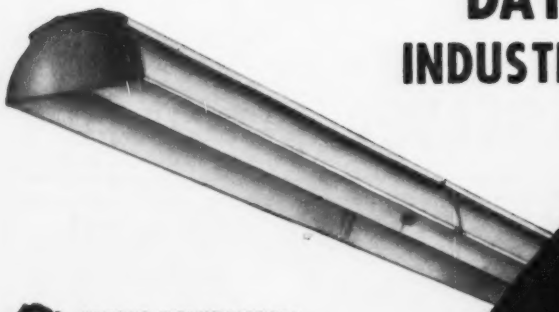

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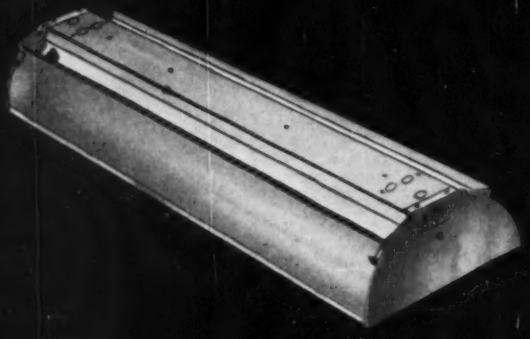
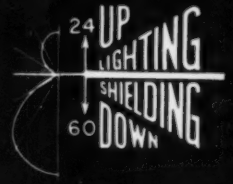
4. INDIVIDUAL OR CONTINUOUS MOUNTING — quick and easy mounting methods adaptable to any type of installation. Provision for sliding clamp hangers, conduit stems or chain hangers.

Superior distribution ratios—Upward and Downward —Plus better shielding!!





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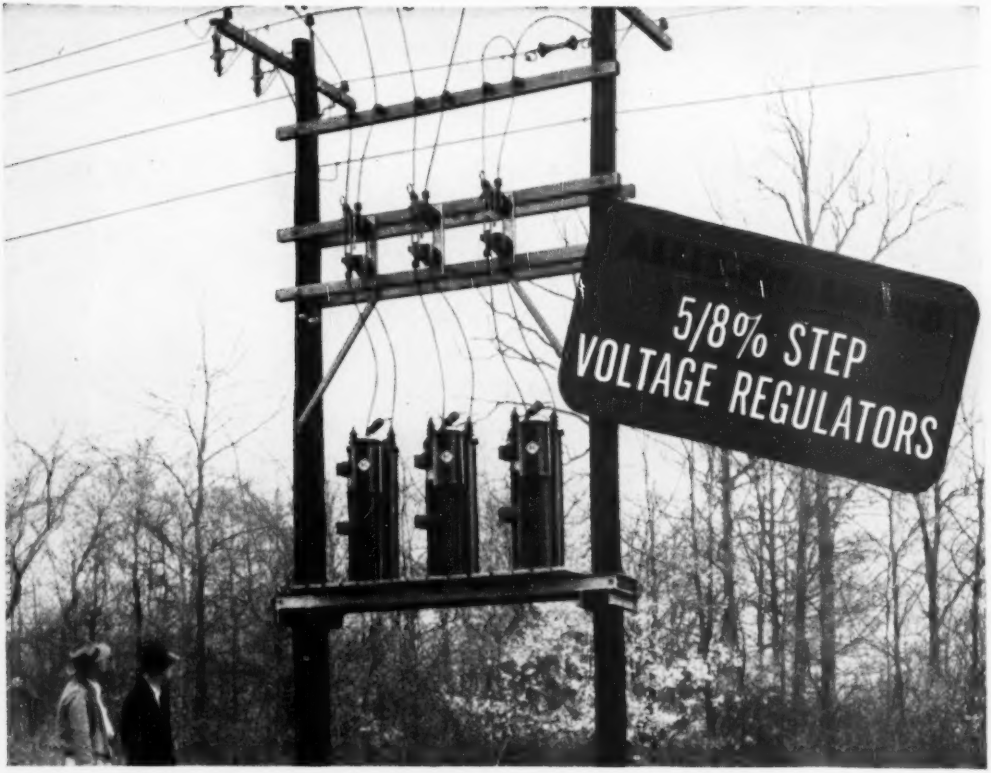


Get Voltage Regulation at Low Cost

With All 32-Step Regulator Advantages

HERE'S THE ANSWER to your voltage problems. Allis-Chalmers distribution regulators are low in cost. They are easy to install, simple to maintain. And they give *all* the advantages of Allis-Chalmers 5/8% step regulation: a narrow ± 1 volt band, 20% range of regulation, long-life contacts, and *Feather-Touch* control.

In addition, Allis-Chalmers distribution regulators have proved their reliability in eight years of field operation. Experience has also proved another major advantage: they are flexible. Their ease of installation and setting makes it easy to shift them from feeder to feeder.

Get all the facts on these low cost units. Call your nearest A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3882

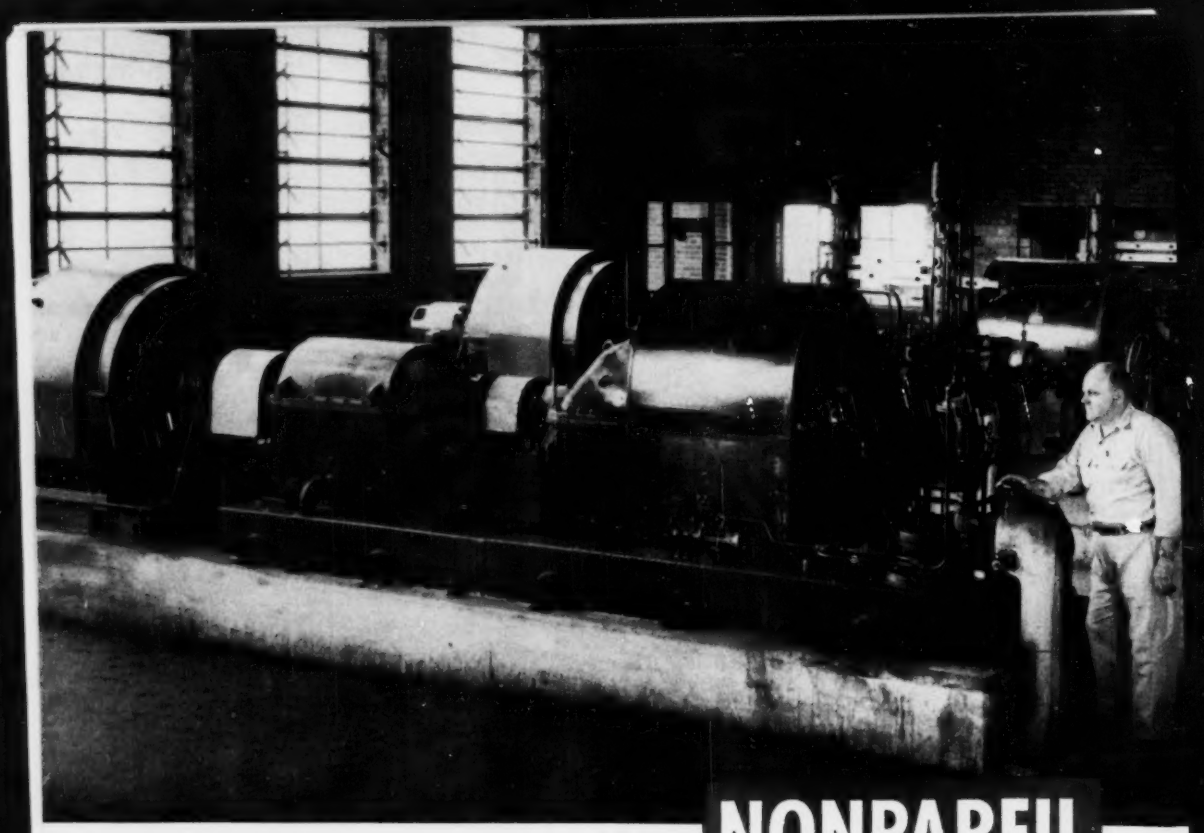
RATINGS AVAILABLE	7620 Volts—15, 50, 100 amp 5000 Volts—50, 100 amp 2500 Volts—100, 200 amp

Feather-Touch *Control Simplifies Installation*

There's just one adjustment to make when installing — set the calibrated voltage level. For more facts, write for Bulletin 01M7866-1.

ALLIS-CHALMERS

Originators of 5/8% Step Regulation



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Through the use of NONPAREIL, officials of this Milwaukee tannery are assured of clean, trouble-free lubrication for the *life* of their turbines. This assurance is based on the written guarantee, given with each fill of NONPAREIL, that this outstanding lubricant will last for the *life* of the turbine it lubricates and that it will maintain a neutralization number below 0.15 mg. KOH/gm.

The Standard Oil lubrication specialist in your section of the Midwest will be glad to tell you about NONPAREIL's written guarantee. He will show you NONPAREIL operating records that cover up to 25 years' service in a single turbine. You can contact this lubrication specialist by phoning your local Standard Oil office. Or write, Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

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